PUBLICATION OFFICES:
168-177 POTTER BUILDING, NEW YORK.
Telephone Call: Murray 586. Cable Address: "Electrical," New York.
W. J. JOHNSTON, Editor and Publisher.
T. COMMERFORD MARTIN, JOSEPH WETZLER, } Associate Editors.
CLARENCE E. STUMP, Business Manager.
WALTER T. HUNT, Advertising Dept.

New England Office, 178 Devonshire Street, Boston.
W. I. BARKER, Manager.
Western Office, 44 Lakeside Building, Chicago.
E. L. POWERS, Manager.

SUBSCRIPTION, IN ADVANCE, ONE YEAR, $3.
(Including Postage in the U. S. or Canada.)
IN CLUBS of 4 or more the rate is $2.50 a year each; with a free extra copy to the getter up of a club of 8.
Subscription to foreign countries, $5 a year.
In requesting your address changed, give **old** *as well as new address.*

ESTABLISHED **FOURTEEN** YEARS AGO.
THE ELECTRICAL WORLD
IS THE PIONEER WEEKLY ELECTRICAL JOURNAL OF AMERICA, AND HAS WELL MAINTAINED ITS LEAD.
IT HAS THE LARGEST CIRCULATION
OF ANY ELECTRICAL PERIODICAL IN THE WORLD, AND IS
THE BEST ADVERTISING MEDIUM.

Correspondence, views and opinions on all topics within the province of this journal are cordially invited from any part of the world. We will thank readers to forward to us—**promptly** as they occur—**Items of News,** or information relating to any application of Electricity, also marked copies of their local papers containing anything likely to interest electricians. Anonymous communications cannot be noticed, nor can rejected manuscript be returned, unless accompanied by the necessary postage when received.

Advertising Rates are much lower than those of any other similar publication, circulation and standing considered, and vary according to space, position and number of insertions. Quotations promptly furnished on application covering these points.
For Sale Notices, Situations or Help Wanted, $1 to $2 an issue.
Matter for the **Editorial** Department should be addressed to
The Editor of The Electrical World, New York.
Subscriptions and communications relating to **Advertising** or the **Business Department** should be addressed to
W. J. JOHNSTON, Publisher,
Potter Building, New York,
OR EITHER OF THE BRANCH OFFICES.

"THE ELECTRICIAN" IN THE UNITED STATES AND "THE ELECTRICAL WORLD" IN THE UNITED KINGDOM.
Arrangements have been made by which the London "Electrician" can be obtained from THE ELECTRICAL WORLD *office, 168-177 Potter Building, New York.*
The rate of subscription (payable in advance), including postage, is $6 per annum to any address in the United States, Canada, Mexico or other foreign country.
Single copies, price 10 cents, can also be obtained at THE ELECTRICAL WORLD *office. Similarly* THE ELECTRICAL WORLD *can be obtained in England at the office of* The Electrician, 1 *Salisbury Court, Fleet Street, London, E. C.*
The rate for English or foreign subscribers (payable in advance) £1. 1s.

CONTENTS.

ILLUSTRATED ARTICLES: PAGE.
Some Points in Distribution by Transformers ... 194
The Law Lightning Arrester (Corr.) ... 194
The Dynamo Telegraph Plant at Pittsburgh, Pa ... 195
The Rogers Auxiliary Fire Alarm ... 196
A New Vertical Steam Dynamo ... 197
A New Medical Dynamo ... 197
New Cabinet Galvanic and Faradic Medical Battery ... 198
On a System of Electrical Distribution ... 199
The Davis Police Signal System ... 200

NEW BOOKS:
"Materialen Fuer Kostenvoranschlaege Elektrischer Lichtanlagen" ... 194

MISCELLANEOUS:
Transformers in Medicine ... 194
Heating by Electricity ... 197
Maritime Telegraphing ... 197
Blow-Out in Incandescent Lamps ... 198

MISCELLANEOUS: PAGE.
A Practical Lecture on Electricity ... 198
The Sprague Electric Transfer Table at Altoona, Pa ... 198
Lombardy Poplars as Lightning Rods ... 198
Electric Lines on Public Highways ... 199

SPECIAL CORRESPONDENCE:
New York Notes ... 200
New England Notes ... 200
Philadelphia Notes ... 201
Western Notes ... 201
Southern Notes ... 202
English Notes ... 202

DEPARTMENTS:
The Telegraph ... 203
The Telephone ... 203
The Electric Light ... 203
Applications of Power ... 203
Personals ... 203
Miscellaneous Notes ... 204
Business Notices ... 204
Our Illustrated Record of Electrical Patents ... 204

VOL. XII. NEW YORK, OCT. 13, 1888. No. 15.

Wires Along Highways. IN view of the interest taken just now in the rights of electric companies to run and maintain wires along highways, we have printed the charge to the jury of Judge Depue in a case which was brought to the notice of the recent telephone convention. The judge's discussion of the points at issue is excellent, and though the jury gave a verdict against the telephone company, it is clear that it will not be safe for anybody to cut a wire simply because he has a yearning to do so.

Electricity in Medicine. THE great steps which have been taken in the application of electricity to the treatment of disease are well illustrated in the constant improvements made in electro-medical apparatus. Heretofore, the voltaic battery has been the main source of current supply for such work; but the demands of not a few physicians are so great, that the care and renewals are such as to make a larger supply desirable. Hence we find the latest application in the special form of dynamo designed for the use of physicians, as described in another column. With a simple gas or water motor, or better still, with the use of an electric motor to drive the machine, the physician can now consider himself entirely independent of the galvanic battery, which he generally views as rather a nuisance.

Pleading Guilty by Telephone. A NEW use for the telephone has just been found at Toronto, where a citizen being summoned to answer a charge in the police court for some slight, technical offence, and being unable to attend in person, telephoned to the court the admission of his guilt. He was fined $1 and costs through the same medium of communication. This is certainly a prompt and convenient way of dispatching the business of a court, but it seems to us open to some objections which could be well met by the use of a phonograph. We expect to see that machine largely used for affidavits, depositions and the like, and we know of one case at the present time where it is being employed to determine an important trademark dispute which has reached the stage of litigation. The phonograph record, to be sent from this country to England, we believe, is intended to prove how a certain vocal combination sounds and is produced.

Safety in Transformer Distribution. IN this issue Mr. Ludwig Gutmann elaborates a statement made by him some time ago, in our columns, in which he sought to prove that the higher the potential the safer is the alternating system of transformation. He takes the case of three systems of different voltages, and shows that with the same relative amount of leakage in each in the converters, or to ground, currents are developed which act on the safety fuse, not in direct proportion to the relative voltages, but as the square of the same; so that in a 2,000 volt system the strain on the safety fuse in the primary circuit will be 44 times as great as that on the 300 volt system. Mr. Gutman, while admitting that 300 volts is primarily considerably less dangerous than 1,000 volts, asserts that with the proper training of those in charge of the circuits, and suitable means of preventing the consumer from coming in contact with the primary, the higher voltage is to be preferred on the ground of safety.

Are Mariners Moles? IT has been a popular belief for ages that mariners are blessed with exceptionally strong vision, but certain events of late have gone to upset that notion. Not long since, owing to the opposition of navigators in the East River, the brilliant electric lights at Hell Gate were abolished. Then action was taken against the arcs that illuminate the Brooklyn Bridge so beautifully and successfully, and it really looks as though those lights must go because of the clamor unless something can be done to screen their rays waterwards. Of course, it was to be expected that gruff voices would be raised against Liberty's lighted torch, and we suppose that the objections to electricity there will be allowed to prevail by-and-by. Now comes a local mariner who writes to the New York daily papers against the buoys which are to be lit by electricity for Gedney's Channel, and who is "very much afraid that the proposed multiplicity of buoys and lights will be the cause of much danger rather than of safety." Having a reasonable familiarity with all these various installations, we refuse flatly to believe that the use of electric lights is objectionable in every one of them, or in any of them. If our local seamen are not suffering from weak eyes, they must be credited with some of that repugnance to change or reform which has always, as much as keen sight, been attributed to their profession. Perhaps they are feeling the physical effects of our navigation laws, which are said to operate against the breeding of a hardy race of mariners.

Wire for Alternating Currents. INVESTIGATIONS on the action of lightning and its mode of discharge seem to have strengthened the conclusion that the charge is alternating in its character, and that it is carried principally upon the surface of the conductor. This was shown nearly 20 years ago by Profs. Hughes and Guillemin in their experiments on lightning arresters, made for the French government. They then determined upon a flat ribbon as the best form of lightning conductor. This subject is allied very closely to the investigations recently made by Sir William Thomson and brought out by him in a paper before the British Association. Sir William shows that as one of the applications of Fourier's law of diffusion a conductor carrying alternating currents should be specially adapted to transmit that current. Thus, assuming the alternations to be at the rate of 150 per second, the electrical disturbance penetrates the substance of the copper to no greater a depth than three millimetres, so that nothing is gained by using a conductor having a greater semi-depth than that just given. It follows, from this, that conductors intended to carry heavy alternating currents should be in the form of hollow tubes or flat bars, or separate wires. This conclusion, arrived at theoretically by Sir William Thomson, may find some modification in practice; but even as it stands, it is well to take the idea into consideration when heavy alternating current distribution is contemplated. Of course, the depth of penetration of the disturbance varies with the number of alternations, and by reducing these any depth desired can be reached.

Storage Station Lighting. WE publish this week, an illustrated abstract of the interesting paper read before the British Association by Mr. Henry Edmunds, on his ingenious system of electrical distribution by means of secondary batteries. In this plan, broadly stated, it is proposed to provide each customer with low-volt lamps, supplied with current from a small number of cells of large ampere capacity, and to keep a certain number of cells always on the charging mains, through which a constant current is to be maintained. By means of a switch, operated by a light electric motor, a couple of cells are exchanged every two minutes from the charging to the discharging circuits, and thus the cycle of operation is kept up. Much ingenuity is exhibited in working out the details, and Mr. Edmunds thinks that the system will be particularly useful in lighting suburbs or scattered houses. It is offered as a solution of the problem of giving each house its own individua supply of current continuously day and night, and independent of any interruption in working at the central station or of trouble in circuits. Other uses might be found for the system, but its chief recommendation in practice, despite a little complexity, would probably be its saving in the cost of generating plant as well as in other economies to which attention is directed.

Technical Instruction of Capitalists. IN trying to account for the great rapidity with which new ideas and inventions are developed in this country, as compared with the slowness abroad, many reasons have been suggested. Principal among these we may cite the oft-quoted conservatism prevalent in European countries, and that timidity which causes a man to shrink from entering upon enterprises of the ultimate success of which he himself is not capable of judging. But while this is undoubtedly so, the true cause may perhaps be looked for in yet another quarter; and it may be as Prof. Forbes pointed out recently, that America's success is due largely to the technical and mechanical education of many of her men of capital. With their training it is evident that they can form a tolerably good judgment of the value or practicability of a new device, and upon this their capital is readily forthcoming. The cause for this lack of technical education among men of capital abroad is quite apparent. It may be set down as a general rule, that, respecting and obeying the prejudices and practices of the past, moneyed men abroad, whether "new rich" or old, shrink from educating their sons in the mechanical arts, which are still a little outside the bounds set by social caste. Consequently a liberal education, as it is called, takes the place of a course in science or the arts. When we consider the general practice among our capitalists of sending their sons to technical and mechanical schools, there need be no fear for a future lack of technical education among those who are to have the disposition of large funds, even though European social restrictions should unfortunately come to enjoy more weight here than they have had hitherto.

Dynamo Telegraphy. ALTHOUGH, as was recently pointed out by Prof. S. P. Thompson, the early telegraphs of Gauss, Weber, Steinheil and others, were operated by means of magneto-electric apparatus, it is only of late years that dynamo electric machines have been regularly employed for the purpose of generating current on telegraph circuits. Perhaps the most notable instances at the present time are the plants in this city at the headquarters of the Western Union and Postal Telegraph companies, both of which have been described in our columns during the present year. In this issue, however, we call attention to another plant of the same character, and one which embraces several features of novelty. Not only are the circuits supplied with current from these dynamos, but the dynamos themselves are driven by electric motors, which, in turn, are operated from the motor circuits of the local electric light company. Another feature is that the current is used on a large scale for the "local" circuits, and as Mr. Maver has said in his article this is the first time that dynamos have been used to replace "local" batteries. The plant has been installed under the supervision of Mr. S. A. Duncan, who as an old telegrapher, as well as a leading electric light engineer of the modern school, is thoroughly familiar with all the difficulties of the problem, and who, in co-operation with Mr. Gerritt Smith and others, appears to have made a distinct and brilliant success of the experiment. The number of cells displaced in Pittsburgh by the main line machine is placed at about 12,000, and by the local machine at about 1,100, and the office at Pittsburgh is probably the first in the world at which there is no chemical cell or battery employed. It is noteworthy that all the other machinery in the office is driven by dynamo current, and that, as the article mentions, in the telephone office in the same city the generators for the telephone company are also driven by motor. If our electric light readers cannot see a very direct "pointer" in this plant, as to the manner in which they also can supply current from their stations for telegraph purposes, we are afraid that they are not quite abreast of the times or equal to their opportunities. We think, however, that many of them will be doing considerable work in this field at no very distant date.

NEW BOOKS.

MATERIALIEN FUER KOSTENVORANSCHLAEGE ELEKTRISCHER LICHTANLAGEN. By Etienne de Fodor. Vienna: 1888. A. Hartleben. 224 pp. 5 × 7 in. Price, $1.20.

Although the application of the electric light has made enormous progress within the last few years, and the light has become thoroughly well established, the installation of an electric light plant is still a mystery to the majority of those who contemplate entering the field. The practical man especially, who cares little for theory, but looks more to the matter of dollars and cents in connection with electric lighting, will find little in the books which have heretofore appeared, that shall give him the information by which he can estimate the cost of installing and operating his electric light plant. The author has sought to fill this want by bringing together a large number of facts, formulæ and tables by which such an estimate can be made by one who has not made electricity a specialty. Thus the book contains methods of calculating the cost of conductors by the various systems of distribution, data on the best known dynamos, and a complete tabulation, with a description, of the various auxiliary matter necessary for the proper maintenance of an electric light plant, whether central station or isolated. The author has also gone into details by describing the different conditions prevailing in different types of installation, such as those for ships, theatres, public places, railroad depots, factories, etc. The arrangement for central stations with continuous and alternating currents, and also in connection with storage batteries, is very fully described, and the latest data on this subject brought out. Indeed everything which would be brought into consideration in estimating the cost of electric lighting has been borne in mind by the author, and we would recommend a perusal by all interested in the progress of electric lighting. The book is well illustrated and forms a valuable addition to the "Elektrotechnische Bibliothek." Such a work in the English language, would, we think, be a considerable aid to many who, though recognizing the advantages of the electric light, are still in doubt as to its economy, and we throw out this hint to those who are competent to undertake the work. Naturally, the figures contained in the book apply to foreign, and especially to European practice, but the work contains, nevertheless, much that is valuable to all interested in the subject, and by no means ignores American practice.

Some Points in Distribution by Transformers.

BY LUDWIG GUTMANN.

The distributions by transformers,* having in their primary circuits a pressure of 1,000 volts, have been attacked and considered dangerous; another system has been proposed of a tension of 300 volts.

It would not be wise to reject a system without sufficient proof of its danger, just as it would be very wrong to

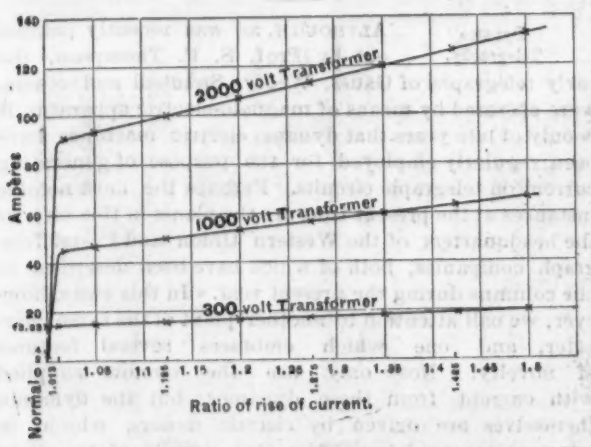


FIG. 2.—RATIO OF RISE OF CURRENT.

adopt another of which the safety has not been demonstrated.

As the comparative merits may be of interest, I shall, in this paper, endeavor to show by figures the respective reliability and safety of a 2,000 volt, a 1,000 volt and 300 volt system. In case of a ground in a transformer, from the primary coil to the secondary direct, or indirect, through the core to the secondary, it is necessary that the insulation of the primary coil be damaged, and the bare wire be in close proximity to the core or the secondary coil. In either case it would be evident that more or fewer turns of the primary coil would be cut out of circuit, its length would be reduced and the resistance decreased. The greater the change in resistance of the primary coil, the greater will be the current that is forced through the primary fuse. We have, therefore, not to do directly with the current itself, but with the pressure employed and the resistance of the coils, or the rate at which the resistance can alter.

Let us now compare three systems worked with 2,000 volts, 1,000 volts and 300 volts. For example, I use a transformer of the same capacity in each case, say one that supplies 80 lamps at 50 volts and 1 ampère per lamp. To simplify matters I will assume that there is no loss in the apparatus by transformation. The work which the secondary and also the primary have to perform is 50 × 1 × 80 = 4,000 watts. This work is equal in all three cases, but as the pressure is different the currents in the primary

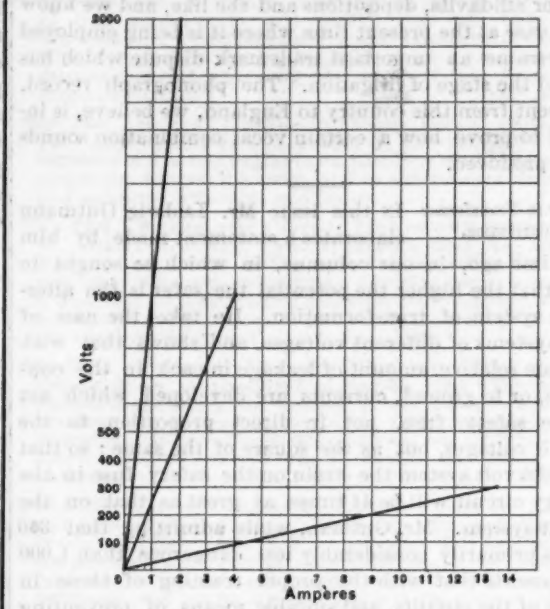


FIG. 1.—EXTERNAL CHARACTERISTICS OF TRANSFORMERS.

coils are also different, and are found to be in the 2,000 volt, 1,000 volt and 300 volt system respectively:

$\frac{4,000}{2,000}$ = 2 ampères; $\frac{4,000}{1,000}$ = 4 ampères; $\frac{4,000}{300}$ = 13.33 amp.

The virtual resistance in the primary coils at maximum load would be respectively:

$\frac{2,000}{2}$ = 1,000 ohms; $\frac{1,000}{4}$ = 250 ohms; $\frac{300}{13.33}$ = 22.5 ohms

The virtual resistance of the secondary coils in all three cases would be $\frac{50}{80}$ = .625 ohm. I assume that (for practical purposes) the change of resistance in the primary coil which can take place is from normal to that of the secondary circuit, and is respectively: 1,000 : .625; 250 : .625, and 22.5 : .625, or the ratio of change would be as:

$\frac{1,000}{.625}$ = 1,600 : 1; $\frac{250}{.625}$ = 400 : 1, and $\frac{22.5}{.625}$ = 36 : 1.

Now let us suppose that in all three coils a ground takes place which cuts out say one-fifth ($\frac{1}{5}$) of each coil; the rate of change of current or the strain on the fuse will be, respectively as 1,600 : 400 : 36, or if we call that of the 300 volt system one (1), we have the ratios respectively: 44.44 : 11.11 : 1.

These figures show that the same ground in the three converters has not the same effect, but that the current developed, and, therefore, also the strain on the primary fuse, is in the 2,000 volt system 44.44 times; in the 1,000 volt system 11.11 times as great as in the 300 volt system. Hence it follows that the safety of the secondary circuit with which the public has to come in contact is in the same proportion to these figures.

These ratios are more striking still if 100 volt lamps would be used with the 300 volt system, which would probably be done to compensate for heavier expense of primary conductors. In this case they will be found to be respectively as 177.77 : 44.44 : 1, or the 2,000 volt system is 177 times, and the 1,000 volt system 44 times, as safe as the 300 volt system.

As a matter of fact, the resistances of the primary and secondary coils are nearer equal to one another the less these two circuits differ in pressure, and, if a slight ground occurs, it does not follow at all that the fuse will break in a 300 volt system. On the contrary, fuses are here no protection whatever, and we have in such a case the 300 volts in our secondary circuit without knowing it. To demonstrate this, let us continue our first-mentioned example. I will assume that a slight ground occurs in all three transformers, so that the current in the 300 volt coil will rise from 13.33 ampères to 16 ampères. This would not by any means cause the fuse to melt, but would allow the higher pressure to enter the secondary circuit. The ratio of this rise would be:

13.33 : 16 = 1 : x, or x = 1.2.

The rise of current in the three transformers would be respectively: 1.2 × 44.44 × 2 ampères; 1.2 × 11.11 × 4 ampères, 1.2 × 1 × 13.33 ampères; equals 106.656 ampères, 53.328 ampères, 15.996 ampères. The currents which have to pass a 2 ampère, a 4 ampère and a 13 ampère fuse have changed into 106, 55 and 16 ampères respectively. I would like to ask whether a 2 ampère fuse can carry 106 ampères; if a 4 ampère fuse can carry 54 ampères, and whether a 13 ampère fuse which has to carry this current constantly will melt with 16 ampères?

My former paper might have given the impression that the reliability depends on the fuses themselves, but these figures show that the fuse, however well or badly made, enters little into consideration, and that it is the nature of the transformer system that makes the fuses reliable or unreliable. This reliability does not alter in direct proportion to the tension employed, but as the square (second power) of the quotient of the pressures of the two transformer systems compared; $\frac{2,000}{1,000}$ = 2, and 2^2 = 4. The 2,000 volt system is four times as reliable as the 1,000 volt system. These figures agree also with the first ratio found, $\frac{2,000}{300}$ = 6.66, and 6.66^2 = 44.35. The 2,000 volt system is 44 times as reliable or safe as the 300 volt system, $\frac{1,000}{300}$ = 3.33, and 3.33^2 = 11.099. The 1,000 volt system is 11 times as safe as the 300 volt system.*

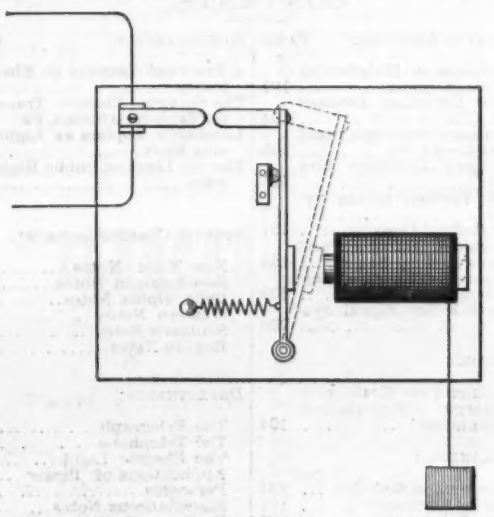
The reason for this fact is obvious. In transformers of the same type, and with equal number of alternations, the counter pressure developed is proportional to the length of wire under induction; therefore, the primary wires in these three coils have a length respectively 6.66 : 3.33 : 1. Again, the work done in all three cases is equal, but is also equal to volts × ampères. It follows, therefore, that the currents stand in the reverse ratio to the pressure, and are respectively 1 : 2 : 6.66. If we now consider that by a ground not only a length of wire is cut out, but also that the ampère-turns are reduced, we at once see that the number of turns cut out for the same fault, or for equal reduction of ampère-turns, stands in the same ratio as the pressure, and, therefore, the effect must be as the square of the quotient of the pressures compared.

Fig. 1 of the accompanying diagrams shows the currents under normal conditions and Fig. 2 represents the change of currents in the three transformers for equal faults. The rise of current in the 300 volt cost is taken as the basis.

I must admit that 300 volts in the primary circuit is several times less dangerous than 1,000 volts, but with due precautions and proper training of linemen there will be but little danger, while on the other hand the public, as shown above, is exposed to 11, or 44, times as much danger of a shock from the primary current in the 300 volt system.

Transformers in Medicine.

Mr. J. Macintyre, M. B., in a paper read at the annual meeting of the British Medical Association last month at Glasgow, after alluding to the expense and difficulties of arrangement for the various medical purposes required when either primary or secondary batteries are employed, suggests that the transformer will probably in the future



FORM OF LIGHTNING ARRESTER.

be generally adopted for this purpose, and expresses the opinion that a cheap and portable transformer suitable for all medical purposes would be of great value to the profession.

The Law Lightning Arrester.

To the Editor of The Electrical World:

SIR: I notice in your issue of Sept. 29, 1888, a description under the above title which tallies perfectly, as does also the figure, with Fig. 4 of my patent 321,464, of July 7, 1885.

It is quite possible that Mr. Law does not know of the existence of this patent and the figure which I herewith enclose. (See cut.) A casual inspection will show that the device of this figure and the Law lightning arrester are in all respects identical, both in principle and mode of operation, the description in the patent itself being very clear.

I am not surprised at the fact that these arresters have been found to work perfectly during thunderstorms, the only surprise I have being that this form of lightning arrester should have been put forward as something new.

LYNN, Mass. ELIHU THOMSON.

* I wish to call attention to the fact that medical coils, potential raising and reducing coils are called without distinction "converters." This name is too vague; it may mean as well an African missionary, as any mechanical or electrical apparatus which changes natural force or matter into a more convenient form. It is necessary that a special name be adopted for potential reducing or "safe system" coils, especially since the advocates of the continuous current have already diverted the attention of the people from the continuous current for capital punishment, which would, of course, give the public the impression that alternating currents and their distribution by means of transformers are more dangerous. How can we expect the public to know the difference between "safe system" coils and potential raising coils, if electricians do not make any distinction? The present state is injurious to transformer distribution, and leaves a powerful weapon in the hands of the supporters of the continuous current. A better name to adopt for coils reducing from *high to low* tension would be "transformer," which term is not so common, and appeared first with the parallel system and originated with Messrs. Zypernowski & Blathy. Two other simple names are "changer" and "reducer." For potential raising coils the name of converter may be maintained.

* The inaccuracy of the ratios is caused by the incomplete decimals.

The Dynamo Telegraph Plant at Pittsburgh Pa.

BY WM. MAVER, JR.

In a recent article published in these columns on a new dynamo-electric machine plant in the Western Union building, New York, I mentioned that it was intended to remove the old plant to the new office of the Western Union Telegraph Company, at Pittsburgh, Pa. This intention has since been carried out, the new plant in that office having now been put into successful operation (Fig. 3.).

A novel as well as interesting feature of this installment is that the dynamo-electric machines used for the supply of electricity for the wires are driven by electric motors which receive their electro-motive force from the leads of the "motor" circuit of the Allegheny County Electric Light Company, Pittsburgh.

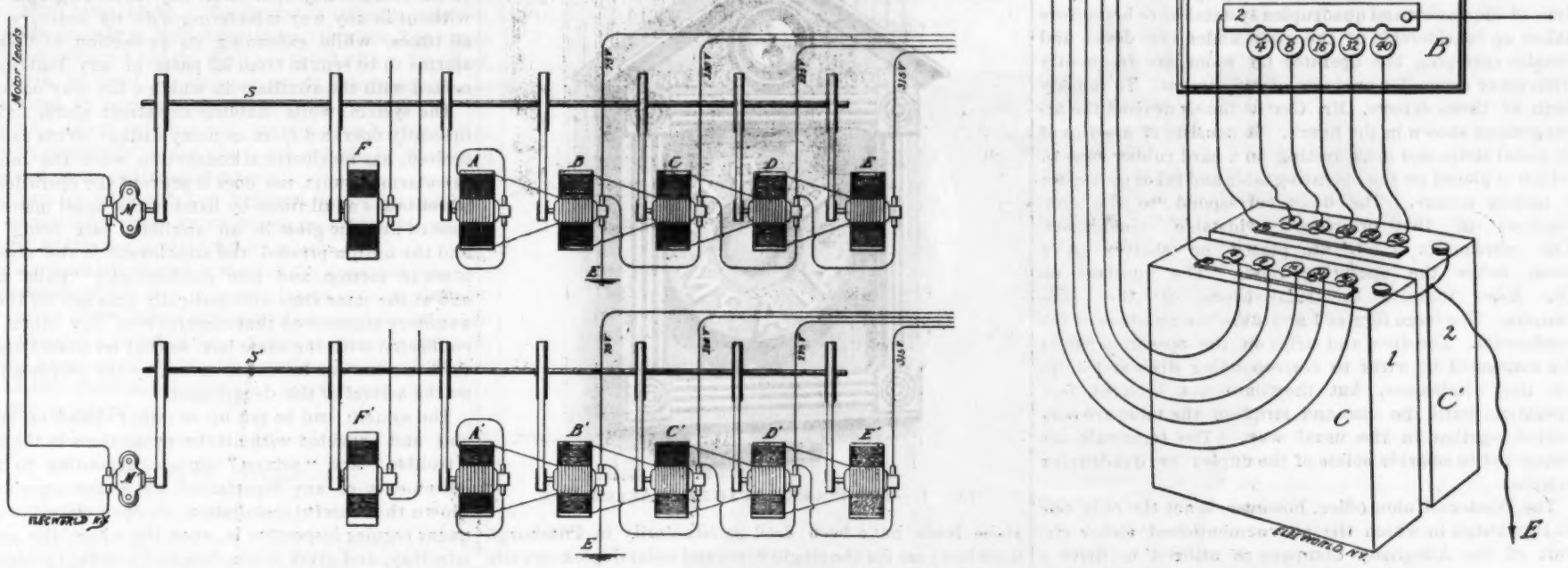
As in the equipment of this new office advantage has also been taken of the experience gained from the previous use of these dynamo machines as generators of electricity for telegraph purposes, and also of the knowledge derived in other ways to devise and put into operation some improvements a description of the whole may not be amiss, more especially as for perhaps the first time in the history of the telegraph, dynamo-electric machines have also been introduced in that office to supply electromotive force for the operation on a large scale of "local" circuits.

The general arrangement of the Pittsburgh equipment is shown in Fig. 1, in which *M* and *M'* are Sprague electric motors of 10 h. p. each. These motors are attached, as shown, to the leads of the motor circuit of the Allegheny County Electric Light Company, which circuit supplies, it is said, in all about 100 motors in Pittsburgh. The motors are connected in multiple arc. The E. M. F. at their poles is about 110 volts, and when doing their maximum work they give out about 8,800 watts. The motors are compound wound and are self-governing. In actual operation they show no perceptible variation in running under the ordinary changes in their loads. The motor pulleys are connected by belting to the shafts *S S'*, on which are carried the pulleys corresponding to the pulleys of the different dynamo-electric machines.

The arrangement of the machines assigned to the duty of generating E. M. F. for the main line wires in the Pittsburgh office is practically the same as described in the article already referred to,* and therefore it will only be necessary to briefly recapitulate that description.

Machines *A*, *B*, *C*, *D*, *E* and *A'*, *B'*, *C'*, *D'*, *E'* are two series of dynamo machines of the Siemens-Alteneck type. *A* and *A'* are shunt wound and self-exciting machines, and furnish a magnetic field for the other machines. The armatures of the machines *B*, *C*, *D*, *E* are connected in series, so also are those of the machines *B'*, *C'*, *D'*, *E'*. *B*, *C*, *D* and *B'*, *C'*, *D'* furnish an electromotive force of 75 volts each; *E* and *E'* furnish 90 volts each; thus at the fourth machine of each series the E. M. F. is 315 volts. One series of these machines furnish positive, the other negative polarity to the wires. There is also a third series, not shown in the diagram, which, by a suitable switch, furnishes negative or positive polarity, as required. As many of the wires emanating from the office are of different resistances, it is desirable to have varying degrees of E. M. F., and to that end main wire leads are run from each machine to the switch-board in the operating room, thus giving four different grades of potential, namely, 75, 150, 225 and 315 volts, respectively.

The machines *F F'* are also run by the motors. These machines, which are of special construction, and were manufactured by Messrs. J. H. Bunnell & Co., are used in the generation of current for the local circuits in the office and the short circuits in the city emanating from the office. But one machine is run at a time, the other machine being held as a "spare." These machines can furnish an electromotive force of 15 volts and 34 ampères



FIGS. 1 AND 2.—ARRANGEMENT OF DYNAMOS AND CONDENSERS, PITTSBURGH DYNAMO TELEGRAPH PLANT.

running at 950 revolutions. Ordinarily they are only called upon for from 17 to 24 ampères.

Usually about three gravity cells of battery are required for office local circuits and 15 to 25 similar cells for the city local circuits; the local circuits ordinarily have about 4 ohms resistance and the sounders used on short city circuits about 20 ohms. In order that these circuits may be operated from the same machine, the local sounders and the city line sounders have been wound to about 40 ohms each and, in addition, a resistance of about 60 ohms has been inserted in each office local circuit to compensate for the line resistance of the city circuits, all of the local and city line circuits being in multiple arc. It is obvious that in a larger office it would be desirable to provide separate machines of suitable capacity for the office circuits and the city circuits, respectively, and this will doubtless be done when dynamo-electric machines are more generally used in telegraph offices as sources of electromotive force for the local circuits.

The number of cells displaced in Pittsburgh by the main line dynamo machines may be estimated at about 12,000. By the local machines, about 1,100.

In addition to operating these dynamo machines, the motors also supply power to run the blower for the

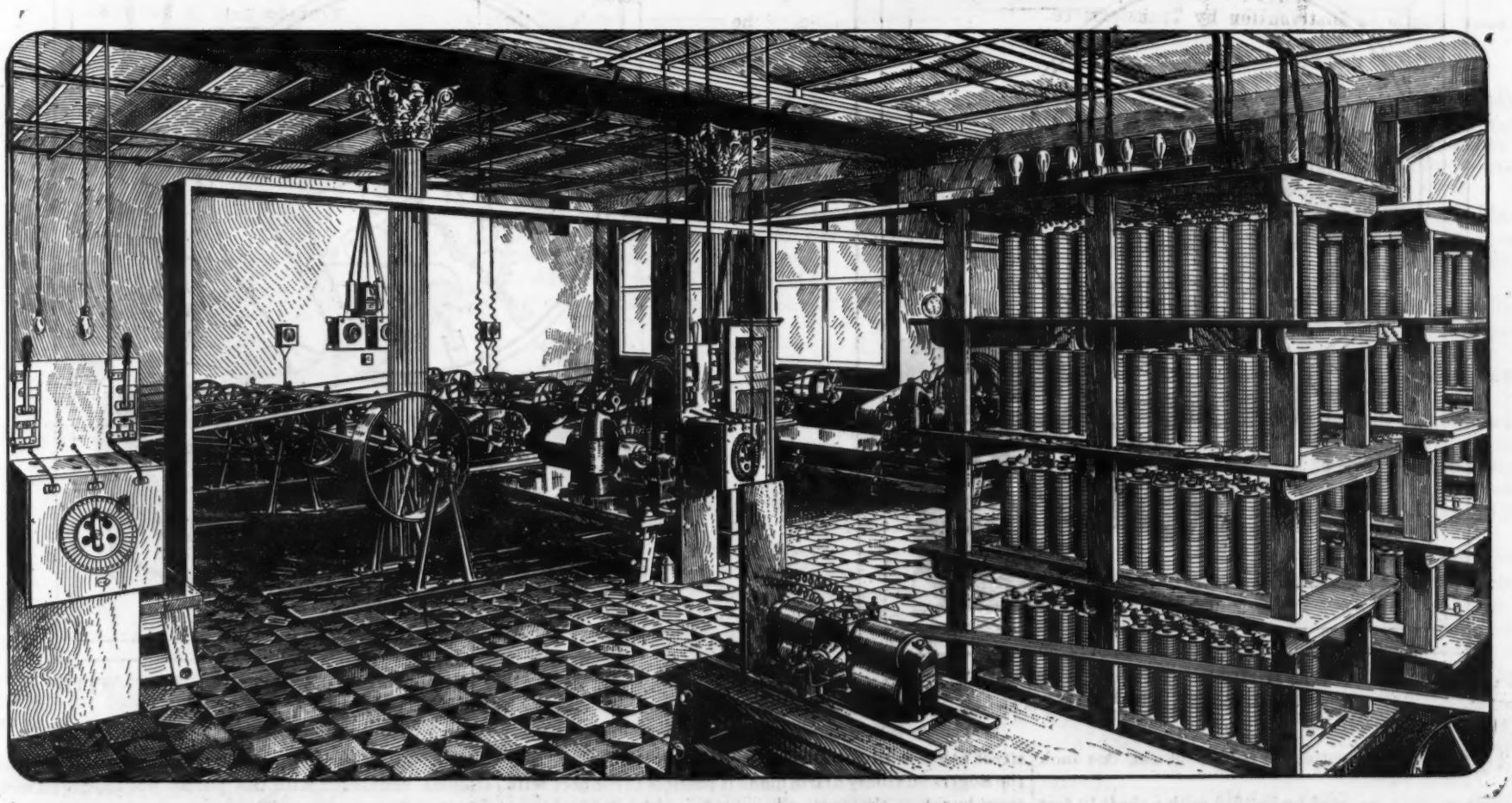


FIG. 3.—WESTERN UNION DYNAMO TELEGRAPH PLANT DRIVEN BY ELECTRIC MOTOR, PITTSBURGH, PA.

*See THE ELECTRICAL WORLD, Feb. 11 and 18, 1888.]

pneumatic tubes between the operating room and the receiving and delivery departments on the ground floor of the building.

This is perhaps the first and only telegraph office in the world in which there is not a chemical cell of battery employed, and, doubtless also, it is the only office of its kind in which the motive power employed in the operation of all the office machinery is electricity. The result is a very neat and well lighted "battery" room, in striking contrast to the general run of such rooms.

In Fig. 2 is illustrated one of the improvements referred to in the equipment of the Pittsburgh office. It is well known that the condensers employed in the operation of the duplex and quadruplex systems have heretofore taken up considerable of the space under the desks, and besides cramping the operator for room, are frequently difficult of access for purposes of adjustment. To remedy both of these defects, Mr. Gerritt Smith devised the arrangement shown in the figure. It consists of a series of of metal strips and discs resting on a hard rubber base *B*, which is placed on the operating table and takes up a space 4 inches square. The discs correspond to the connections of the ordinary adjustable condensers. The condensers *C C'* are placed on shelves in a room below the operating room. The numbers on the doors indicate the subdivisions of the condensers. The large figures 1 and 2 are the numbers of the condensers. The discs and strips on the operating tables are connected by wires to corresponding discs and strips on the condensers, but they are not brought into operation until the disc and strip on the table are connected together in the usual way. The terminals are connected to suitable points of the duplex or quadruplex system.

The Western Union office, however, is not the only one in Pittsburgh in which the above mentioned motor circuit of the Allegheny Company is utilized to drive a motor, which in turn provides the motive power of a generator of electricity, the Central District and Printing Telegraph Company, of that city, having used that circuit, as I am informed by the general manager of the company, Mr. Henry Metzger, for some time past in the operation of two Sprague motors that drive 15 generators in the general office of that company. These motors are of one half h. p. each, and are run 12 hours, alternately. The motors and gearing are fastened on a heavy oak platform 4½ × 9 feet, the whole resting on rubber blocks one inch thick.

The motors are connected by belting with a shaft 10 feet in length and 1¼ inches in diameter. The generators are mounted on a table composed of an oak plank 10 feet long by 14 inches wide, which is placed about 30 inches above the shaft, and the generators are driven by belts from the shaft. There are no pulleys on the shaft. To facilitate tightening the belts, each generator is fastened to a board 12 inches long by 6 inches wide, one end of which is made fast to the table by a pair of hinges; the other end rests on an adjusting screw by means of which the board can be raised and the belt drawn tight. Each generator is connected by a suitable cord and plug to a given switch-board, where connection is made with the telephone call wires. In case of a generator failing the cord and plug attached to the corresponding switch-board is connected to any working generator. Provision is made for the failure of the motors by means of an extra spring jack switch which permits the transposition of the cords connected to the generators to a commutator of a 30 cell Callaud battery.

Another interesting fact in connection with this subject is that the generators of the Allegheny motor circuit are driven by steam engines whose fuel is natural gas.

It may occur to some to inquire the reason why the leads of the Allegheny Company are not used directly for the supply of electricity for the wires. It is that the potential from those leads is fixed and not sufficiently high for all the requirements. As a matter of fact, however,

Fig. 1.—The Rogers Auxiliary Alarm Box.

these leads have been used satisfactorily in Pittsburgh since last year for the single wires and polar duplex circuits which do not require over 110 volts potential, this connection having been made immediately after the destruction by fire of that office.

The Rogers Auxiliary Fire Alarm.

Though the first fire-alarm telegraph in the world was established in the city of Boston nearly forty years ago, its benefits and protection were not extended beyond the street boxes until a few years ago, when the invention of the Rogers auxiliary alarm made it possible to connect with these boxes, so that from all parts of neighboring buildings they could be instantly operated without first finding out where they were and then running to and opening them.

We give on this page an illustration of the system, Fig. 1, showing the local signal box, in which is situated an electric button protected by a glass seal, which is broken in case of fire. Fig. 2 shows the attachment placed in the ordinary "wind up" type of street boxes, the shaded part being the auxiliary and the outline part the ordinary alarm mechanism as now used in all such boxes. Fig. 3 shows a self winding alarm box such as is used in most of the large cities, with the Rogers mechanism shown shaded, which winds up and sets the box in motion when any of the auxiliary buttons are pressed.

This new system is the invention of Mr. Charles D. Rogers, superintendent of the American Screw Company, of Providence, R. I., and was in practical use in the great establishment under his control for nearly a year before it was brought into general notice, though during that period it excited considerable interest, and met with the approval of local fire department and insurance circles.

The new invention being a little later brought to the notice of the Boston Fire Department, their superintendent, Captain Brown S. Flanders, was quick to recognize it as a step in advance of existing methods, but saw that it required some changes and additions to make it adapted for use in the larger cities, and, becoming greatly interested in what promised to improve the service, he soon made the required changes, so that now the Rogers system can be advantageously applied to any fire telegraph system without in any way interfering with its ordinary use at all times, while extending its protection and enabling alarms to be sent in from all parts of any building connected with the auxiliary in which a fire may occur.

The system, while enabling any street alarm box to be instantly operated from as many distant points as may be desired, has no electrical connection with the municipal fire-alarm circuits, nor does it prevent the operation of the street boxes at all times by hand in the usual manner. In case of fire, the glass in an auxiliary box being broken and the button pressed, the attachment in the street box is set in motion, and this mechanically "pulls" the box and at the same time automatically cuts out all the other auxiliary stations on that circuit or on any other circuit connected with the same box, so that no second alarm for the same fire can be sent in except by the proper authority on the arrival of the department.

The system can be put up on either closed or open circuit and provided with all the protections in the way of "trouble" and "return" signals, according to the requirements of any department, but so far experience has shown that careful installation on open circuit with frequent regular inspection is, upon the whole, the most satisfactory, and gives as absolute and constant protection as can be expected from the fire-alarm telegraph itself.

Being, after severe tests and several months' trial, approved by the fire department, the system was adopted by the city of Boston as an extension of the protection of the fire-alarm telegraph, and under the inspection of the proper officers was introduced into many of the leading hotels, schools, factories, car shops, steamship docks, etc.; and extending to other cities, it was equally well received, until now, although hardly two years since it was introduced, there are nearly one thousand Rogers auxiliary stations connected with the public fire telegraph in over fifteen different cities. The system is operated by private companies formed for the purpose, and its introduction into any town or city only needs the sanction and co-operation of the local department, without adding anything to its expense, the company depending upon its rentals for the care and regular inspection of the service.

The introduction of this alarm is in the hands of the Alarm Box Controller Company, of Providence, R. I., represented by Mr. Charles E. Bailey, president, and local companies for its operation have already been organized in a number of States.

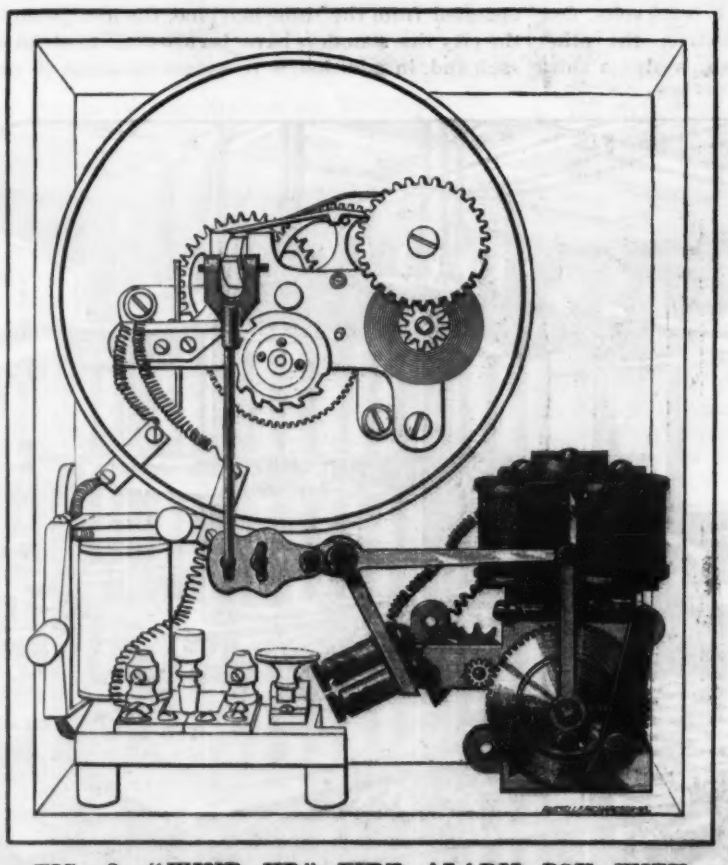


FIG. 2.—"WIND UP" FIRE ALARM BOX WITH AUXILIARY ATTACHMENT.

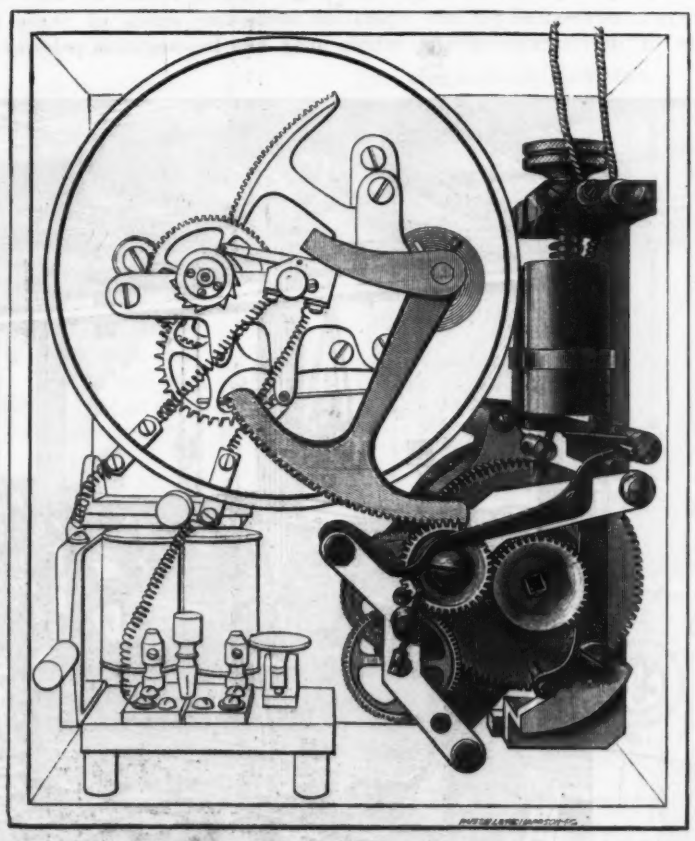


FIG. 3.—SELF-WINDING FIRE ALARM BOX WITH AUXILIARY ATTACHMENT.

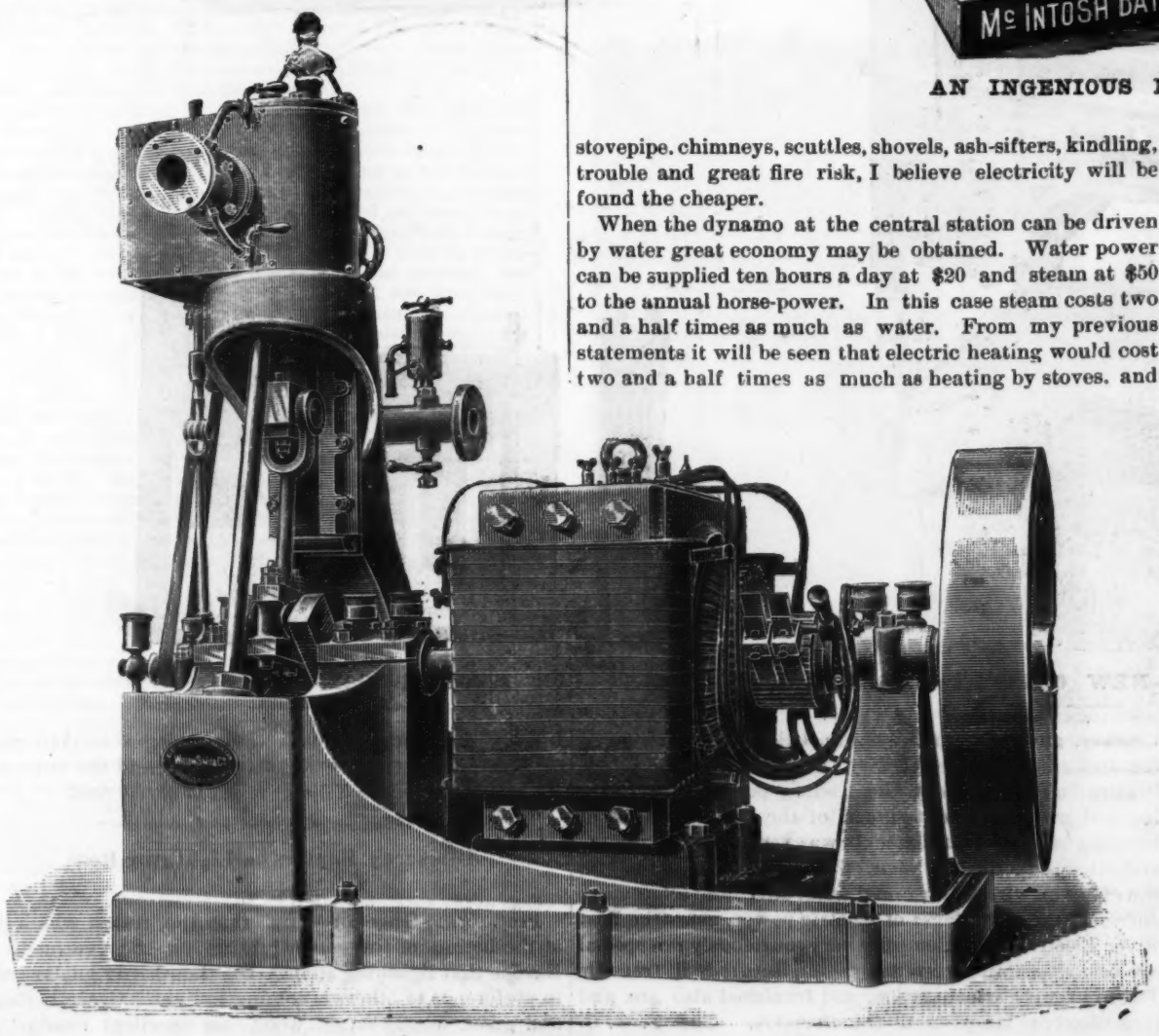
A Defaulter Convicted.—W. H. Masterson was sentenced to four years in State prison last week for stealing $4,700 from the Edison Company, of this city, for which he was collector. His devoted wife made restitution by turning over property she had recently inherited.

A New Vertical Steam Dynamo.

Our illustration represents a new vertical steam dynamo recently designed by Messrs. Willem Smit & Co., of Slikkerveer, Holland. In order to avoid the losses due to friction wheels and similar forms of driving mechanisms, and to avoid complication, the armature is fixed direct to the crank shaft, as shown in the engraving, and mounted in bearings on a strong cast iron base, bored out at one operation. This armature is of the ordinary Gramme type, surrounded by magnets of convenient shape, magnetically insulated from the frame by means of a zinc base plate. To insure a steady rotation, and consequently a light free from vibration, the crank is counterbalanced and the shaft provided with a fly-wheel, which can be used for driving other machinery at the same time, or during such time when the light is not required. Great care has been given to the lubrication of all parts, especially in the crank pin, which is lubricated by means of its centrifugal action.

Uniformity of speed for different loads is controlled by a special high speed valve governor, placed behind the cylinder at the top, and driven by a belt.

The dynamo illustrated is wound for constant potential to a capacity of 200 16 c. p. Edison lamps, or a corresponding number of arc lamps and incandescent lamps in parallel, working at a speed of 300 revolutions per minute, with a steam pressure of 90 to 100 pounds. The smallest size built of this combined engine and dynamo has a capacity of 15 16 c. p. lamps.



A NEW VERTICAL STEAM DYNAMO.

Heating by Electricity.

BY JAMES ASHER.

Little has yet been done in heating by electricity. The common belief is that it would be too costly. We can get 90 per cent. of the total energy as useful heat from a furnace and but 10 per cent. from an electric current derived from a dynamo run by steam. Stoves do most of the heating in towns and they give but one-fourth of the total energy in useful heat. Three-fourths of the heat passes up the chimney. Air rushes through crevices of doors and windows in draughts which are injurious to health.

Suppose the case of a house heated by electricity in a town. Let the current come from the central station, and heat coils of flat iron wire. These coils may each cost less than a dollar, and they may be in any part of the house. For cooking and baking the coils may be placed just under or around the vessel holding the article cooked. Less heat than usual would be required, for no soot would be on the bottom of the containing vessel. The fire risk would be much less than at present, as the wire never need be hot enough to cause fires. The heat supply can be turned on or off instantly; thus there will be no loss of fuel when the need of heat has ceased. This applies with great force to summer use.

In heating, cooking, or baking, the temperature can be easily kept uniform. Without rising in the morning, the touch of a button at the bedside will turn heat on several coils in different parts of the house. The nuisance of kindling, smoke, ashes and soot, will be abolished, and no stovepipes and chimneys will be needed.

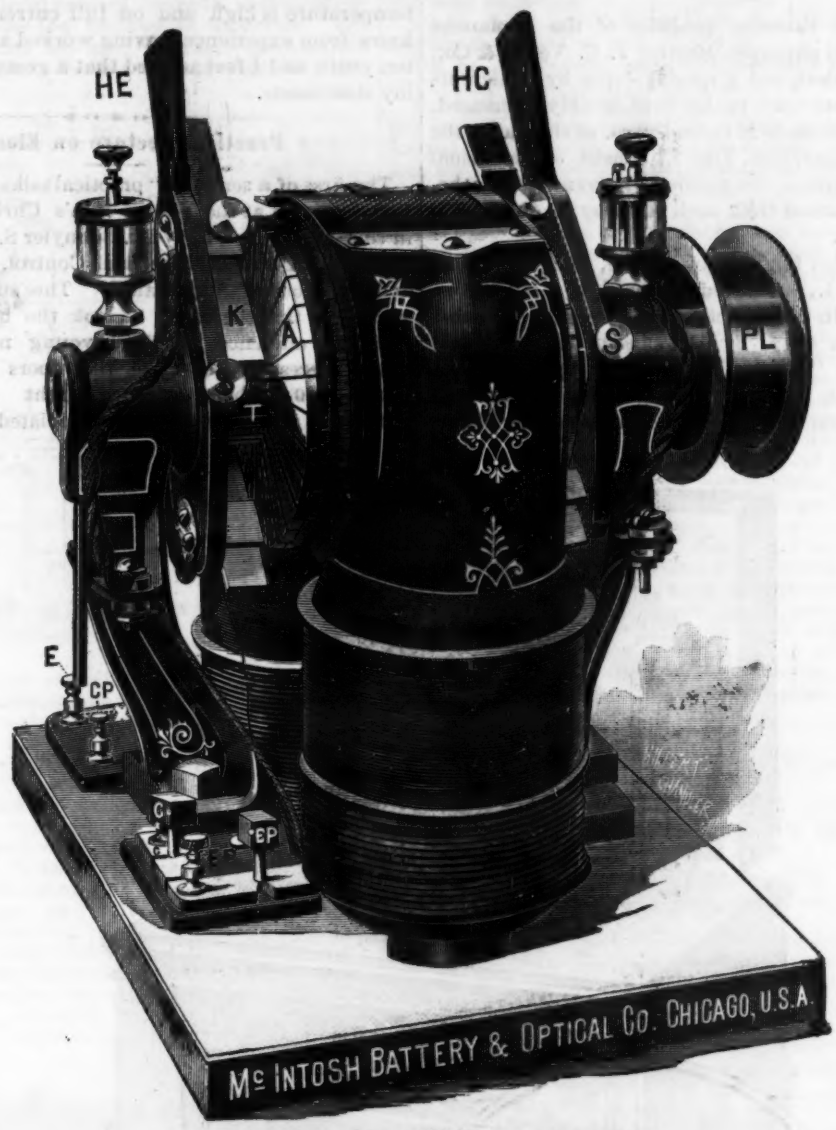
I have said that we may get 10 per cent. of the heat energy expended at the central station, and that in using a stove we may get 25 per cent. When we count the cost of stovepipe, chimneys, scuttles, shovels, ash-sifters, kindling, trouble and great fire risk, I believe electricity will be found the cheaper.

When the dynamo at the central station can be driven by water great economy may be obtained. Water power can be supplied ten hours a day at $20 and steam at $50 to the annual horse-power. In this case steam costs two and a half times as much as water. From my previous statements it will be seen that electric heating would cost two and a half times as much as heating by stoves, and in using water power to generate electricity the heat will cost the same as when produced in stoves, even neglecting the cost of stove pipes, chimneys, etc.

Platinum wire has been used for electric heating, but surely the fact that iron is as good must have been ignored. The conductivity of soft iron is nearly as low as that of soft platinum. The ratio at the temperature of melting ice is as 20.73 to 18.03, and the cost nearly as 1 to 5000. I propose to use flat wire, for better results will be had when the heating surface is large. The coils may be suspended from the ceiling.

A New Medical Dynamo.

Owing to the growing importance of the galvanocautery and the possibilities of the electrolytic current of high electromotive force, the medical profession frequently require a more economical and durable means of accomplishing their purpose than primary batteries. In order to meet this want the McIntosh Battery and Optica Company, of Chicago, have designed a compact form of dynamo which is so constructed as to afford a wide range of current qualities such as are employed by the physician.



AN INGENIOUS MEDICAL DYNAMO.

As will be seen in the accompanying engraving, the machine practically embodies within itself two dynamos, one for high E. M. F. and small current, and the other for low E. M. F. and strong current.

These two windings are connected to two separate commutators, one on each side of the armature; and the field magnets are doubly wound as shown. The coarse winding is connected to the armature winding of low resistance so as to give an E. M. F. of 5 volts and a current of 60 ampères, while the fine wire field coils are connected to the high resistance armature winding, and give a current of 1 ampère at an E. M. F. of 200 volts. By inserting the proper plugs either current can be drawn on at will, or both worked together, as they are entirely independent of each other.

The varieties of current generated are available for cauterization or for galvanization, and the energy is sufficient to operate two 16-candle lamps, smaller lamps being also adapted to use for surgical purposes. The currents generated can be regulated to a nicety by means of external rheostats placed near the operator, the dynamo being located at any convenient station, and driven by a water motor or small gas engine or by an electric motor.

The machine designed by Mr. Elmer A. Sperry runs at a speed of 1,500 revolutions, and requires from ½ to ¾ h. p. to drive it

Maritime Telegraphing.

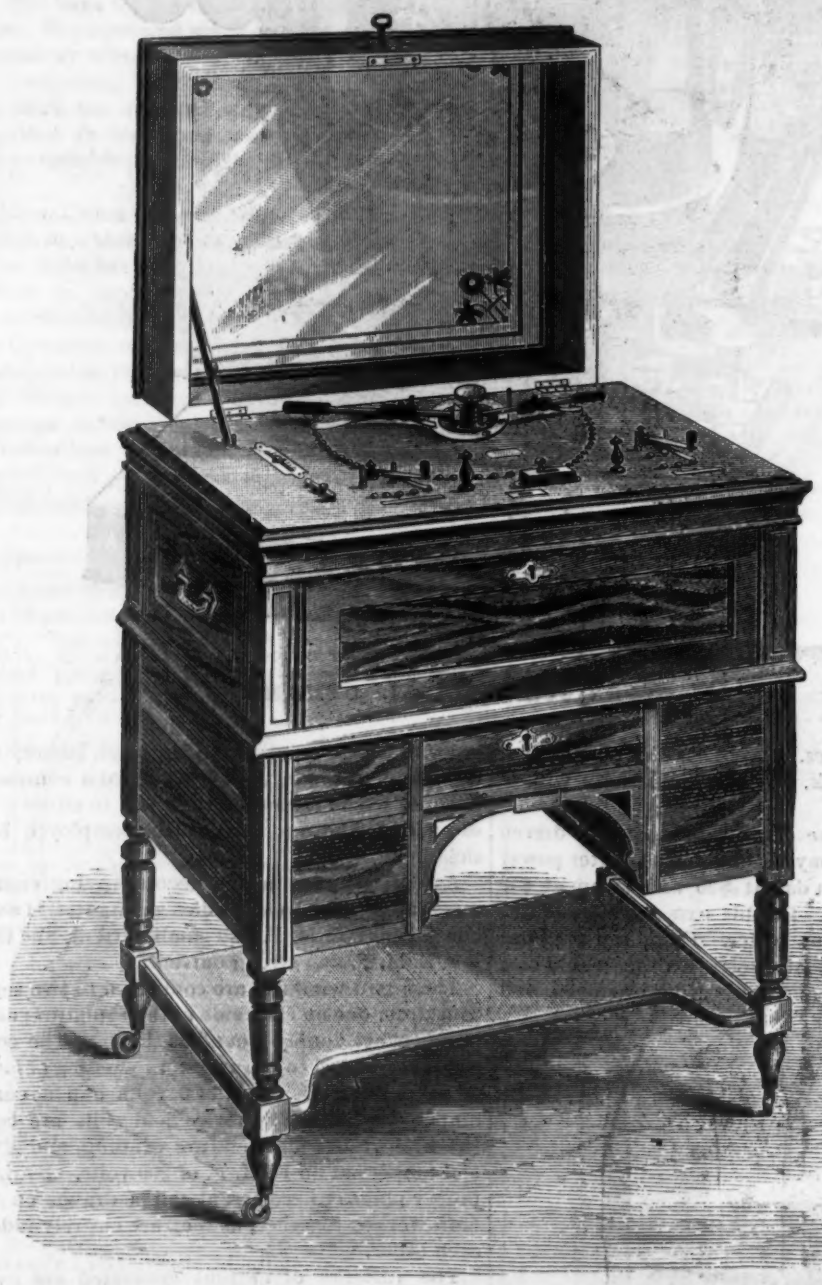
M. A. Banaré has communicated to the French Academy of Sciences the result of some experiments in submarine telephony he had undertaken in the harbor of Brest, by order of the Minister of Marine, on Aug. 2 to 13, with the aid of an apparatus he has named the "hydrophone." In these experiments the sounds produced under water by means of various sounding instruments, bell, whistle or trumpet, have been able to be transmitted under the water; those of a bell weighing 300 pounds were easily perceived at all distances allowed by the conformation of the harbor, so as to avoid sandbanks or promontories between apparatus and the point of emission of the signals The greatest of these distances was 5,200 metres (3¼ miles), and the sounds were quite clear and distinct. An official commission was appointed to test the action of the submarine apparatus as compared with the direct sound of

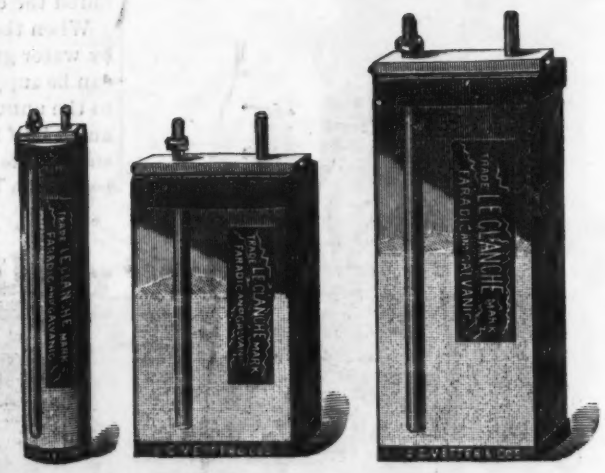
whistle with a moving steamer with very good results, the submarine signals being heard beyond the latter to a distance of one mile. The sound of the bell was always heard with great clearness, in spite of the noise of the machinery and of the screw.

New Cabinet Galvanic and Faradic Medical Battery.

Recognizing the valuable qualities of the Leclanché battery for medical purposes, Messrs. J. C. Vetter & Co., of this city, have designed a special form by which its lasting qualities are said to be considerably increased. The cells which are made in three forms, as shown in the accompanying illustration, Fig. 1., consist of the usual rods of zinc and carbon, surrounded by granulated coke, the two being separated from each other by a diaphragm of wood.

In the size adapted for physicians' use, the cylindrical cell shown in Fig. 1., is adopted, inclosed in a case illustrated in Fig. 2. In this 60 cells occupy a space 14 inches long by 8½ inches deep, by 7½ inches in height. These are connected to a "selector," as shown, by which any number of cells can be brought into operation at will, through the medium of a switch. The engraving Fig. 3.





FIGS. 1, 2 AND 3.—NEW CABINET AND OTHER BATTERIES FOR MEDICAL USE.

shows a new physician's cabinet battery made specially roomy to contain 120 cells of the larger size, and nearly 300 of the smaller. In addition the cabinet is furnished with four large Leclanché porous cup cells for operating a faradic coil, all under the control of switches. The whole presents a very neat and compact arrangement.

Blow-out in Incandescent Lamps.

BY M. J. HANKINS.

In a recent issue of THE ELECTRICAL WORLD, I note an illustration of an incandescent lamp bulb blown out at the side while the lamp was burning. I wish to add to this subject my experience as a glass blower, having made lamps for all the leading electric light companies.

It may be remarked that there will often be observed in incandescent lamps a small crack, round in shape, which cannot be seen plainly with the naked eye. These bulbs may pass through the glass blower's hands without being noticed, but when in the pump-room they may be found to leak. But sometimes they go through this department also without being detected. Now, this lamp may burn for months, and then again it is liable to burst out when the lamp is on full current, the sudden bursting of the filament and the sudden strong pressure causing this round piece to fly out. Another suggestion which occurs to me is that bulbs are not of the same thickness all over. For instance, it may be thick on one side and thin on the other. This kind of a bulb is the kind that draws in on the thin side. Again, there may often be observed in a lamp a lump or a cluster of sand, or lime may be found on different parts of the bulb, which is apt to crack in a warm room where the temperature is high and on full current. These facts I know from experience, having worked at the business for ten years, and I feel assured that a great many will verify my statements.

A Practical Lecture on Electricity.

The first of a series of "practical talks by practical men" was delivered at the Young Men's Christian Association in this city on Oct. 5, by Dr. Schuyler S. Wheeler, the expert of the Board of Electrical Control, on "Electricity and Its Modern Application." The subject proved so attractive that before 8 o'clock the hall was crowded with an audience of 1,500 young men, and it was found necessary to close the doors and turn away some 300 others who sought admission. Dr. Wheeler, with whom was associated Mr. Francis B. Crocker, gave an admirable exposition of the practical features and uses of electricity, employing many simple illustrations to bring out the leading points. The focusing and projection on a screen of the electric arc and of burning incandescent filaments was very effectively done, and other experiments showed the effects of induction, the effect on wires of large and small direct and alternating currents, the advantages of electric power, etc. The East River Electric Light Company very courteously ran special arc and alternating circuits into the lecture hall from its Twenty-fourth street station, and furnished also arc and incandescent lamps and transformers. The C. &. C. motor was used to exemplify what could be done with electric power. Mr. Crocker supplemented the scientific part of the programme by a very pithy discussion of the chances of careers afforded to young men in the electrical field. The interest taken by the crowded and intelligent audience was shown not only in the frequent applause but by the fact that large numbers remained standing throughout, and that after the lecture was over a great many persons gathered around the platform and elicited from their good natured instructors explanations that were equivalent to a second entertainment. It is impossible to doubt the good results of such an evening on the minds of so large a body of educated and inquiring young men.

The Sprague Electric Transfer Table at Altoona, Pa.

During the last week the plans for the new electric transfer table to be erected by the Sprague Company for the Pennsylvania Railroad Co., at Altoona, Pa., have been completed, and we are now able to give details in regard to it.

The table will be used to convey cars from one track to another, and will be able to be run over a distance of 295 feet. The table itself is 60 feet long and 17 feet wide. It rests on 8 rails, and is supported by 4 trucks. The motion is imparted to the table by a Sprague electric motor, flexibly suspended at the centre between the two middle trucks, and is geared to the four outside wheels.

The speed will be governed and the table started and stopped by a Sprague patent switch on the centre truck. This switch throws the winding of the field into different combinations, thus altering the power and speed without the use of any resistance. The current is taken to the motor by a conductor placed underneath a wooden beam in the centre of one of the tracks, and at a height of 14 inches above the ground. From this conductor the current is taken by an underneath running trolley wheel. A table very similar to this was erected recently by the Sprague Company at Aurora, Ill., for the Chicago, Burlington & Quincy Railroad. This table has worked very satisfactorily ever since its installation, and the order for the one at Altoona is a direct result of its success.

Lombardy Poplars as Lightning Rods.

Prof. Asa Gray observed that the reason which lies at the bottom of the general belief on the continent of Europe that lightning strikes the Lombardy poplar trees in preference to others is coming to light. Green herbage and green wood—sappy wood—are excellent conductors of electricity. A tree is shattered by lightning only when the discharge reaches the naked trunk or naked branches, which are poorer conductors. An old-fashioned Lombardy poplar, by its height, by its complete covering of twigs and small branches, and their foliage down almost to the ground, and by its sappy wood, makes a capital lightning-rod and a cheap one. Happily no one can patent it and bring it around in a wagon and insist upon trying it. To make it surer the tree should stand in moist ground or near water, for wet ground is a good conductor and dry soil a poor one. It is recommended to plant a Lombardy poplar near the house and another close to the barn. If the ground is dry the nearer the well the better, except for the nuisance of the roots that will get into it.

On a System of Electrical Distribution.*

BY HENRY EDMUNDS.

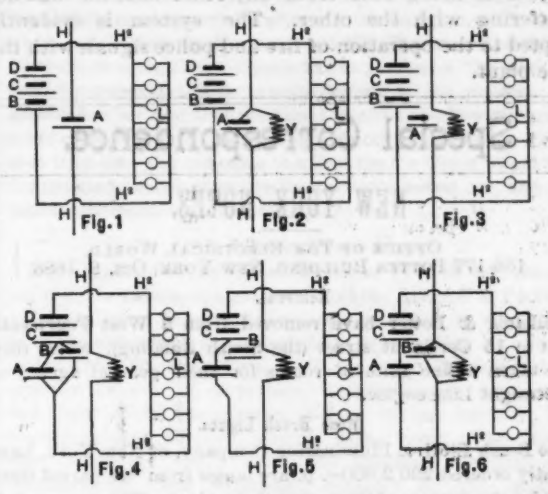
In 1882 and 1883 I was in New York with the Brush Illuminating Company of that city, taking charge of the demonstration there of Mr. Brush's new system, which consisted in the employment of storage batteries, located in groups in series with each other, charged from a common main, carrying a 10-ampère current (the same being used to operate their arc lamps at night), devices being employed to automatically disconnect the batteries from the charging main when fully charged, and *vice versa;* the idea being by this method to obtain double duty from their existing illuminating plant, and enabling them to charge batteries by day and run arc lamps direct at night, the charged batteries at the same time supplying current for incandescent lighting. But in actual practice serious difficulties soon presented themselves. The current employed for charging was too small, and there was not time to charge the batteries sufficiently during the hours of day for any great demand that might be made on them at night. Suggestions were made to obviate this by charging a larger number of small cells in series, and discharging in multiple. But this demanded correspondingly higher voltage pressure in the mains, and at the generating station, which presented very serious practical difficulties. Batteries being so charged could not be used to supply light locally at the time of charging, thus removing the great desideratum in electric service, viz., continuous supply, and, further, the risk of breakage and damage therefrom was greatly increased; besides, batteries under charge have an increased voltage, which either injures the lamps or causes annoyance by fluctuation. Ultimately, after great cost and expense, this promising system was abandoned; and I learnt, when in the United States a few weeks ago, has never been revived.

In England, also, experiments on a large scale were made at Colchester about the same period; here batteries were charged with a high pressure charging current of small volume—duplicate sets of cells were employed so that one set was being charged from the main while the other was discharging locally. But again difficulties presented themselves in practice. The pressure at the station or the charging mains being at least equal to the sum of all the batteries in series, was either very high or else limited the number of groups on circuit that could be charged at one time; also the freshly-charged cells having a higher E. M. F. than those that had been discharging caused serious fluctuation in the lights during the change from the main to the local. And as the cells automatically changed their position from the main to the local only when they had themselves arrived at a certain condition of charge, sometimes the local cells had got over discharged, causing serious damage through buckling and deterioration generally. The result was that the Colchester system was ultimately abandoned.

Having thus far glanced at the history of electrical supply, I now turn to the method proposed and patented by myself known as the Edmunds system of electricity distribution, such as is now being employed in actual practice by the Cadogan Electricity Supply Company, London. This system differs essentially in every point from any of the plans hitherto tried or in operation at the present time, and may be thus described:

A number of groups of cells, which we will call the local batteries, are placed at different points or centres where supply is required in the district, each battery having its individual number of cells according to the voltage required locally, and the amount of current to be supplied. Unlike the Brush method referred to, these local batteries are electrically distinct and independent of each other and of the charging main; neither is there a duplicate set to be changed, as at Colchester, but instead, we employ an additional group with each of the local batteries, which we will term the main batteries, the number of cells of which are a divisor of the number employed locally—generally one-third. For example, suppose the local voltage be 48 volts, 32 cells would be employed, which we would subdivide into 4 groups, 8 cells in each, and for purposes of identification we will call these groups *A, B, C* and *D* respectively. Groups *B, C* and *D* are connected in series in the local (see Figs. 1 to 6), giving 48 volts. Group *A*, being in the main, being charged for a limited period of time—in practice 2 minutes—is then removed from the main charging circuit and placed in the local discharging circuit, when, say, group *B* is removed from the local into the main to be charged. *B* now in turn exchanges places with *C*, and *C* with *D*, so that each group *A, B, C, D*, follow each other in turn from the main to the local or local to main, whereby in every 8 minutes each group has received its increment of charge from the main and has supplied the same in turn to the local, and so on continuously, until in 24 hours each group has received its full charge of current, enabling the battery to maintain its maximum discharge for eight hours, the current employed in practice being 70 ampères, and the size of cells proportionate. Incidentally we find many advantages due to charging cells in this manner. We can maintain a constant potential on the local circuit, so that we have not the interference and fluctuation due to charging and discharging at the same time. The high tension main is never at any time in electrical contact with the local circuit, thereby freeing the system from leakage to earth and its attendant danger. Also the cells are kept in much better condition by continually receiving short increments of charge and having periods of rest from discharge. The loss due to difference of potential between the charging and discharging current is minimised, it being found in practice we can continue charging the cell to its maximum capacity with a mean voltage of 2.25, instead of 2.5 per cell as is required where cells are charged continuously. This, on a large scale, is a considerable element of economy, where there are a number of cells in the charging main. Also we find that an approximately constant potential on the local circuit enables us to run lamps at a higher efficiency, without the risk of rupture due to sudden rises of pressure; and so far as we can judge the life of the batteries is considerably lengthened by this mode of intermittent charge and rest. And in addition to all these advantages we have a great saving in the generating station in cost of plant, only one-third the power being required to operate the same number of lights for eight hours that would be necessary for any direct system, and much less electric force or pressure on the charging mains to supply the same number of lamps, thereby saving cost of installation and chance of leakage.

The additional advantage of being able to run a smaller station for 24 hours in the day is obvious, as we do not have any idle plant with interest thereon. The current being always constant in volume enables a single main of one size throughout to be used, preventing complications and only requiring increase of pressure as the work extends, which pressure would be only one-third the Brush or Colchester systems referred to, for the same number of cells in the local centres, or could, at their pressure, charge three times the number of batteries. For example, where batteries are used in 100 centres on the Brush or Colchester plan, each centre giving 50 volts,



FIGS. 1, 2, 3, 4, 5 AND 6.—A NEW SYSTEM OF ELECTRICAL DISTRIBUTION.

requires at the station a charging potential of over 5,600 volts exclusive of the line, while with the distributor plan it would only require a charging potential of under 2,000 volts for the same work.

The apparatus for carrying out this system which I call a distributor, shown in Fig. 7, combines in one instrument a time mechanism causing changes to occur at regular periods of say two minutes, by energizing an electromagnet at each period, rotating a shaft carrying cams that cause levers to make the necessary contacts for changing the position of the cells from local to charge, and *vice versa;* a polarized switch, whereby the current is prevented from entering the batteries in the wrong direction, and a voltage regulator which causes the batteries as a whole to cut themselves out of the charging main or otherwise, according to their being fully charged, or requiring charge. A simple form of meter registering the current is supplied.

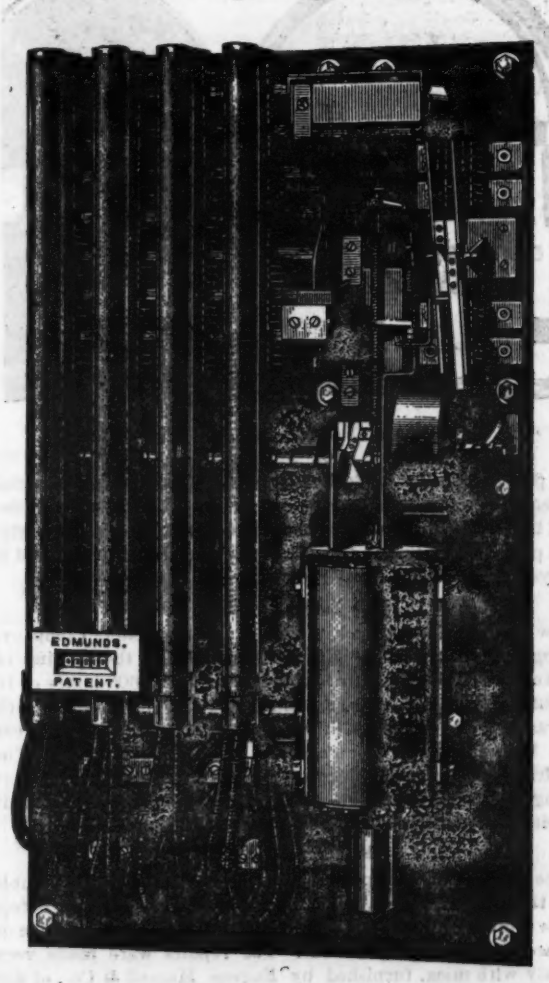


FIG. 7.—A NEW SYSTEM OF ELECTRICAL DISTRIBUTION.

The diagram of the cycles of operation will explain what takes place, and I have constructed several distinct instruments for effecting these cycles, some with levers and mercury contacts, one with rotary brush contacts like a compound commutator, and the one shown in the cut, which we are now using, in the designing of which I have received great help from my assistant engineer, Mr. Albert Howard.

The manner of effecting the cycles is explained by diagrams Figs. 1 to 6. *A, B, C* and *D* represent the accumulators at one point of lighting, which are divided into four equal groups. For instance, imagine there are 32 cells in one house, then the *A* group would consist of 8 cells connected together in series, and *B, C* and *D* the same.

In diagram Fig. 1, *A* is receiving a charge from the central station, over the main cable *H* and batteries *B, C* and *D* are connected together in series, and furnishing currents to the lights *B*. After this state of discharge has been in operation for a fixed interval of time, the distributor begins to work automatically, and makes the various connections necessary, as follows:

Fig. 2. A resistance *Y* has been switched into the main circuit in parallel with battery *A*.

Fig 3. *A* has been switched entirely out of circuit, leaving the main current of 70 amperes, which has never been interrupted, flowing through the resistance *Y*.

Fig. 4. *A* has been switched into parallel with *B* in the local or discharge circuit. This is done without the slightest alteration in the lights, as the electromotive force remains the same as before.

Fig. 5. *B* has been cut out from the discharge circuit, leaving the lights on to *A, C* and *D*.

Fig. 6. *B* has been connected into the main charging circuit in parallel with the resistance *Y*.

The resistance *Y* is then disconnected, leaving the charging current flowing through *B*, which receives a charge for the fixed interval of time, and is then switched back into the local circuit, while *C* receives its increment of charge. In this way each section of the batteries passes through equal periods of charge and discharge.

The time occupied in the mechanical movements of the entire circle is three-quarters of a second, and the period during which the charge is on can be varied at will.

Such a system as I have briefly described lends itself to many purposes in connection with electricity supply. For instance, in the working of railroad switches and signals, electrically, a distribution at each block station would enable a whole line of rail, say 200 miles, to be supplied from one source, the pressure on the main being only a small fraction of the sum of the local pressure; or in electric tramway work, a charged main, well insulated, of high pressure, could supply a number of points en route which in turn could each, independently of the other, supply large volume, low pressure currents locally—saving risk of breakdown and consequent interruption of traffic.

But more particularly is it useful in detached house and suburban lighting, for it solves the problem of giving each house its own individual supply of electricity continuously day and night, totally independent of continuous or regular working at the central station or of interference from other work on the same circuit, being at the same time absolutely safe from the danger of shock, and, above all, supplying the electric light at a reasonable cost.

*Abstract of a paper read at the British Association Meeting, September, 1888.

Electric Lines on Public Highways.

We give below the judge's charge on the above important subject, in the case brought to the attention of the recent telephone convention:

Judge Depue, Essex Circuit Court—The New York & New Jersey Telephone Company vs. Peter Dexheimer.

A person is not justified in cutting or breaking the wires of a telegraph or telephone company legally overhanging a public highway which may be an obstruction in the way of moving a house along said highway.

Contra, if the wires are not legally over the highway.

This was an action brought for damages caused by the cutting of the plaintiff's telephone wires by the defendant, in order to enable him to remove a house along a highway.

This is a case, gentlemen, of some novelty, and, so far as I am concerned, a case wholly of first impression; but inasmuch as it requires, in the decision of this controversy, the application of those principles of law which are well nigh universal, I think I shall have no difficulty in presenting it in such a way as to put you in possession of the legal rights of these parties. If I fall into error, I shall be very glad indeed to have that error repaired here or somewhere else.

The place at which this cutting was done was at a crossing of a public highway, a place at which the public had a right to pass and repass. It was a place, too, at which this company had a right to stretch its wires across and over the public highway for the purpose of engaging in the enterprise for which the company was established. This case, therefore, presents one of those questions that frequently arise where each of the parties have a right at the place in question, and the problem for consideration is what the measure of those rights is when the right of one is brought in conflict with the right of the other.

The defendant admits that on the two occasions complained of he cut the wires of this company which extended across Oakwood avenue, and he claims that that act was justifiable in virtue of the rights that he had in that public highway as one of the public. If the case rested just here, I should feel constrained to charge the jury that the justification was not maintained. The object of a public highway is to accommodate the public for the purpose of such travel and intercourse as are required for public convenience and for the transaction of public business; and I should charge the jury that the use of a public highway for the purpose of travel in moving a building was not within the right which was enjoyable by the public in a public highway. I think there can be no difficulty about that. Where are you going to draw the line? What general obligation rests on the overseer of the highway on a public road to remove branches and projections over the road? Is he to remove them in such a way as to make a clear passage for anything which anybody sees fit to carry over a public highway? It is manifest that the application of such a principle, in virtue of the mere right of the public to use public highways for public purposes, would lead, not only to the most erroneous, but to the most absurd conclusions. Suppose this was in the country, and this building was to be removed for half a mile through a place where the trees projected with their limbs over the road, trees that had been there for centuries, and where they have made not the slightest interruption to the use of the public highway for the purposes for which it was required; if the overseer of the highway were called upon to remove those obstructions, would he be bound to do it? It seems to me that the attempt to bring the case within that principle must necessarily fail, for the reason that the defendant, in the sense that I am considering the rights of the public, was not using this public highway for the purposes of travel; and in my judgment this case turns wholly on the construction of the eighth section of the company's charter, and on the ordinance of the city of Orange.

The first proviso in the 8th section is that "no poles shall be erected without the consent," etc., of the Common Council. (We must assume that this telephone wire was there lawfully.) "And that the same shall be so located as in no way to interfere with the safety or convenience of persons traveling on or over the said roads or highways." I have just disposed of that question. I have said

that this use of roads and highways for the purpose of moving a house on them was not such use as a person was entitled to make of a public highway.

Then the next question comes. "And that the use of a public street in any of the incorporated cities or towns of this state shall be subject to such regulations and restrictions as may be imposed by the corporate authorities of said cities or towns." Now, that the language has received a judicial construction which is broad enough to include the power of the city of Orange to pass ordinances on this subject—independent of that power to pass ordinances, in the exercise of the police power which is always lodged in municipal bodies of this character—and any ordinance that is reasonable and proper, any regulation which the Common Council may adopt on this subject which seems to be reasonable and proper, and it doesn't seem to be unreasonable or improper as a legal exercise of the powers of the corporation, and that the construction of a telegraph line in violation of such an ordinance and regulation is illegal and therefore is subject to be removed by anybody who may use the public streets under permission given by the Common Council. The evidence shows that the defendant, when he engaged to remove this building, obtained the permission of the Common Council to remove it—a permission that gave him another sort of a right from that which inheres in every citizen in the use of the public streets for the purpose of a highway—a permission that wouldn't give him a right to remove the wires of this telephone company which were across the street and in his way, unless those wires were in the position they were in in violation of an ordinance of the city of Orange. You will understand the difference between that right which pervades the whole State, and exists in every one of the public with regard to the use of the highways, and a qualified right of the character of that which I have just mentioned. The ordinance, and the permission given by the Common Council of the city of Orange to this defendant to authorize him to remove this building, while it would give him the legitimate and reasonable use of the street, would give him no right to remove the telephone wires of this company unless they were there in violation of the city ordinance.

An ordinance has been produced, which provides:

"(4) All telegraphic or telephone wires shall be placed so as to hang not less than twenty feet above the street crossing."

Every wire erected by any telegraph or telephone company across the streets of the city of Orange that is less that twenty feet above the level of the street is in violation of that ordinance, and such an erection becomes a nuisance, and any having occasion to use the public highway, whether he be a mere traveler, driving a wagon, or whether he be using it by permission of the Common Council in this way, would be justified in removing any wire that was less than 20 feet above the highway. So that the result of my view of the law and my instruction to the jury is that the permission of the Common Council to the defendant to remove this building affords him no justification for cutting the plaintiff's wires unless they were wires that were in such a position and in such a location as to be less than that distance, the defendant's justification is complete. For all that are above that distance he is without justification, and is liable to respond in damages. So that the case depends altogether on that point—whether any of those wires were as much as 20 feet above the roadway. The testimony of the defendant is that all those wires were less than twenty feet above the roadway. He says that the building stood on timbers three feet above the ground; that the first story was a nine-foot story, and that he stood on the floor and reached up with the pliers and clipped all the wires that he loosened. Now, the nine-foot story, three-foot timbers, the spaces of the floor beams, the spaces above the height of a man, and the height that he could reach using the pliers, are the elements from which you are to determine the result of his testimony with regard to height.

The testimony on behalf of the plaintiff is that all of these wires were less than twenty feet above the level of the ground except thirty, twenty of which were on the upper cross piece, and ten on the upper side of the second cross piece, and the evidence on the part of the plaintiff is that, with regard to the wires that were cut on both of these occasions the wires that were above twenty feet were the thirty wires that I have mentioned.

Now, all I have to say is that with regard to all the wires that were above the line of twenty feet above the level of the street, the act of this defendant was unjustifiable. With regard to the wires that were below, his act is justifiable; because the legislature, in incorporating this company, made it subject to the legislation of the municipal authorities, and there is an ordinance on that subject. The amount in this cause is not great, but the principle is one of vast importance—the right of these companies to enjoy these franchises that are conferred by the act of the legislature, and the right of the corporation, on the other hand, to exercise a reasonable control over every one of these corporations in the passage and adoption of ordinances designed for the purpose of regulating and providing for the convenient use of streets—questions that just now are of great importance in this State; and my instruction to you is that if you find that any of the wires that were cut were above the 20 ft. you will find a verdict for the plaintiff, and an assessment of damages in such sum as, under the evidence would represent the cost and expense of repairing those wires that were lawfully there; for the cutting of any wires that were below the 20 ft., my instruction to you is that the justification is complete.

The Davis Police Signal System.

In order to furnish a police signal system which should combine as many features as possible without introducing too many complications, Mr. Edward Davis, of Cambridge, Mass., has designed a system which individualizes or identifies any officer or citizen who sends a signal, and at the same time includes calls for wagon, gives telephone connection, calls for extra help and signals "fire." The alarm box is shown in the accompanying illustration.

With this system an officer can send his own identifying number and the box number without opening the box and any citizen who has a key can also send his own identifying number (which means he wants police protection) and the box number without opening the box, as a citizen's key will not open a box. When an officer wants a wagon or extra officer, or to speak with an officer at the police station by telephone, or to report a fire, he opens the door of the box and pulls down the lever against the signal he wishes to send.

The time when any message or signal is received is automatically registered at the central office and a record is thus afforded. The system is so designed also that the telephone can be used at any box at the same time that a signal is being sent from any other box, the one not interfering with the other. The system is evidently adapted to the operation of fire and police signals with the same plant.

Special Correspondence.

NEW YORK NOTES.

OFFICE OF THE ELECTRICAL WORLD,
168-177 POTTER BUILDING, NEW YORK, Oct. 8, 1888.

Removal.

Williams & Potter have removed from 2 West Fourteenth street to 15 Cortlandt street (the Smith Building), where they have taken a fine suite of rooms for their general agency of the Straight Line engine.

More Brush Lights.

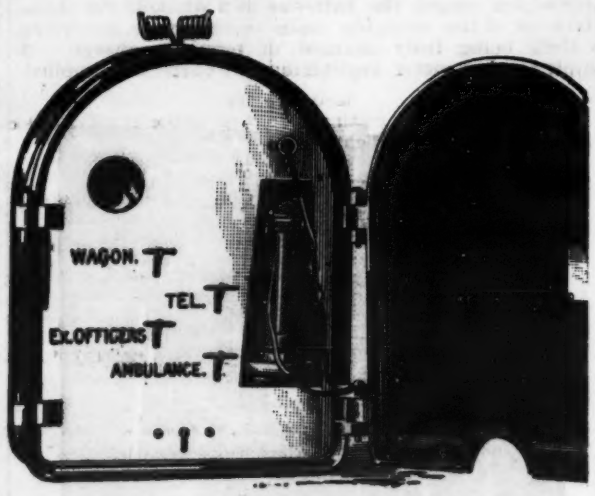
The Brush Electric Illuminating Company, of New York, have recently ordered 230 2,000-c. p. arc lamps from the parent company for the purpose of increasing their plant. This company is now operating between 2,500 and 3,000 arc lights.

The American Company.

The American Electric Manufacturing Company are on their feet again. The factory was opened Monday, Oct. 1., for the making of machines to fill the present orders, which I understand have grown to considerable proportion. They have retaken their old offices in the Telephone Building, 18 Cortlandt street, N. Y., where Mr. R. N. Hazard, the president of the company, will be found prepared to receive all orders for apparatus for arc lighting.

The Equitable Building Plant.

I would like to call particular attention to the method of recording the steam pressure on the Edson recording steam and alarm gauge lately installed in the big United States electric



THE DAVIS POLICE SIGNAL SYSTEM.

light plant in the Equitable Building, 120 Broadway. A special ink record is automatically kept by an ingenious pen lately devised by Mr. J. B. Edson, and the ink flows with precision, giving a plain, heavy line on the chart, which will not fade and is always readable and a ready reference.

The Tucker Company

is now known as the Tucker Electric Construction Company, having dropped the word "Manufacturing." At the opening of the American Institute Fair last week, they had 600 lamps of 16 and 32 c. p. running. Two dynamos of 400 lights capacity each are run from the main shafting. The circuits installed last year have been increased by an addition equal to 160 lamps. The Institute has purchased this plant. The Tucker Company report among their recent installations one of 150 lights for the Medicus Furniture Manufacturing Company of Brooklyn.

Mica for Dynamos.

Note was made in the papers the other day of a little trouble with the plant at the Statue of Liberty, arising from some defect in the commutator of the dynamo, the insulation between one or two sections having burnt out. The repairs were made very quickly with mica, furnished by Eugene Munsell & Co., of 218 Water street, whose mica is noted for its remarkable fineness and excellence. Where mica is used as commutator insulation, there can be no mistake made in getting it as good as possible, and then perhaps it is better than anything else that can be used. I believe I have mentioned it once before in my notes that Mr. Hochhausen, who has had a long experience as a dynamo builder, gives mica a decided preference.

The Sound Steamer "Puritan."

Mr. C. A. Benton, the well-known and successful agent of the Edison Company, has captured the big contract for lighting the new and magnificent Sound steamer "Puritan." The plant will comprise 1,600 16-c. p. lamps and 2 dynamos, and will include all the latest and best appliances of the Edison system. The dynamos will be driven by two Straight Line engines of 80 h. p., each, which will be installed by Williams & Potter. The "Puritan," I may mention, is now lying at the foot of East Ninth street. She is to be fitted up in the old colonial style of white and gold, and it is easy to imagine that the effect of the electric lights and the beautiful fixtures, set off by the elaborate decorations of the vessel, will be something superb. The plant will be the finest on shipboard in the world, just as the steamer herself will be an unparalleled specimen of marine architecture.

System of Electric Light Plants.

I learn from Mr. W. F. Swift, the secretary of the Brush Company, that a notable installation has been that made for the city of Danvers, Mass. The city decided to install a plant of its own, and after receiving a number of bids adopted the Brush system through the agency of Mr. F. A. Rogers. The plant includes two No. 7 dynamos, each of 45 arc lights, and the work throughout has been done in the best style. The plant attracts unusual attention, owing to the circumstances under which it has been put in, and it is, if I am not mistaken, the first plant which has been acquired by any of our Eastern cities. In the West, as well as in some of the Middle States, it is quite common for the city to own a plant; but here, in the East, that state of affairs is still novel and unfamiliar. I understand that Mr. Swift, whose heavy duties call him away, will be succeeded in charge of the New York office about the end of this month, by Mr. S. M. Hamill, Jr., the assistant secretary of the Brush Company, and that Mr. C. S. Haley, formerly of the New York office, has established an agency in Boston, at 113 Devonshire street.

W. T. H.

NEW ENGLAND NOTES.

BRANCH OFFICE OF THE ELECTRICAL WORLD,
178 Devonshire Street, Boston, Oct. 8, 1888.

Boston Electric Exchange.

The quarterly meeting of this organization takes place to-day (8th), at the rooms of the Boston Electric Club. The question of incorporating the Exchange is to be discussed and other important business transacted.

The Loomis System at Wakefield.

Messrs. W. A. Warner and C. Z. Southard, of the Loomis Electric Manufacturing Company, have just finished the installation of a 300-light incandescent plant in the factory of the Wakefield, Mass., Rattan Company.

Poor Telegraph Facilities at New Bedford.

The board of trade of New Bedford, Mass., on Oct. 4 adopted resolutions calling on the Western Union Telegraph Company for better telegraph facilities in that city.

Electric Light and Gas Interests Unite.

Advices from Athol, Mass., under date of Oct. 4, report that a consolidation of the Athol Electric Lighting and Power Company and the Athol Gas Company has been effected.

Personals.

Mr. M. W. Baird, with the Eddy Electrical Manufacturing Company, of Windsor, Conn., is now on an extended tour through the Western States for the purpose of presenting the merits of the Eddy motor to the manufacturers and electric light companies in the West and Southwest.

Long Distance Telephony.

Assistant General Manager J. W. Duxbury, of the New England Telegraph and Telephone Company, who is always a busy man, has been made still busier during the past fortnight contributing valuable assistance in various ways to the establishment of the long distance telephone service in this section. The "long distance" people are getting into service ten additional wires between this city and New York; making a total, when completed, of forty wires between the two cities.

Removals.

The executive offices of the Thomson-Houston Electric Company will be moved during the present month from 178 Devonshire street to the Hathaway Building on Atlantic avenue.

The Synchronous Time Company, of Boston, has removed from the Herald Building to Room 8, No. 25 Congress street.

The Boston Electric Time Company has offices now at No. 1 Columbia street, corner Bedford.

The Eureka Acoustic Telephone Company has occupied new and commodious offices at No. 4 Liberty Square, Boston.

Additional Sawyer-Man Installations.

The following list of isolated incandescent plants of the Sawyer-Man system has just been handed me, with the remark that all are of recent date, viz: 400 lights at the factory of Wm. Knowlton & Sons, West Upton, Mass.; 190 lights at the Berlin Iron Bridge Company's Works, Berlin, Conn.; 125 lights sold to Messrs. Valpey & Anthony, Leominster, Mass.; 60 lights to Henry Adams, Rockville, Conn.; 80 lights to Messrs. Grosvenor & Richards, Saugus, Mass.; and 50 lights for illuminating the Boston offices and salesrooms of the American Tool and Machine Company.

Thomson-Houston Motors.

The Thomson-Houston Company have in Boston a 8 h. p. motor now running an elevator for five stories and six small machines, which formerly required one attendant each. This motor was tested last week by loading the elevator with 1,600 pounds with the six machines running, and the elevator was raised with no apparent effort on the part of the motor and no sparking when the load was changed. Another motor, of 5 h. p., is running, with a 4-inch belt, a large plant consisting of heavy drills and a large blower, which was previously run by a steam engine of over twice the motor's rated capacity, with an 8-inch belt. The Thomson-Houston Company are doing a brisk elevator business, owing to their motor being non-reversible when overloaded and to its perfect regulation under sudden changes of load, etc., and have a number of new appliances for running lifts, etc., by motor at a slight expense when compared with customary methods.

More About "Long Distance."

The following special dispatch to the Boston *Herald*, dated Portland, Maine, Oct. 4, is interesting reading: "Long distance telephone connection was successfully accomplished to-day between Portland and Boston, Providence, New York and Philadelphia, and an order for goods was made by a Providence firm on Portland, and acknowledged at the eastern end of the wire. Providence works as clear and distinct as any short distance line; New York, quite clear; Philadelphia, more muffled. Still, a conversation was kept up between Portland and the Quaker city for

some moments. These connections will be permanent and procurable at all times by the public."

Double-Pole Switches and Cut-Outs.

Mr. Warren S. Hill, manufacturing electrician, No. 133 Oliver street, Boston, reports largely increased sales of his well known double-pole switches and cut-outs for electric lighting purposes. Several electric companies that have used these switches and cut-outs have written to Mr. Hill in favorable criticism on the pieces of apparatus referred to. Mr. Hill reports also having sold recently quite a number of his small incandescent light dynamos (from 10 to 50 lights) and he has received liberal orders during the past quarter for the Hill arc lamp.

Stellar Incandescent Lamps

Mr. S. K. Bayley, the treasurer of the Stellar Electric Manufacturing Company, of Boston, reports that his company is now prepared to furnish at short notice incandescent lamps in sizes from a half to one hundred candle power. Catalogue and price lists will be furnished on receipt of application.

More Electric Lights at Lynn, Mass.

Mr. J. F. Perry, the Superintendent of the Lynn Electric Lighting Company, reports as follows: "The handsome Coliseum Building in my city is furnished throughout with incandescent lights of the Thomson-Houston system, in all about 300 lights of various candle-power. Okonite wire was used exclusively in the installation of this model isolated plant, and was furnished by Messrs. F. E. Pettingell & Company." The material used, and the wiring and construction work, particularly in the installation of the Coliseum plant, was so satisfactory to the owner of the building, Mr. Proctor (of opera house and theatre reputation), that that gentleman has requested Superintendent Perry to accompany him to New York to look after similar electric light installations in other theatres owned by him in the city named.

Schieren Belts in Demand.

Messrs. Charles A. Schieren & Co.'s Eastern Department, No. 86 Federal street, Boston, report a very active demand for their special work in belting. Their electric double leather belt and leather link belt (with patent American joint) have grown steadily in favor, and have acquired a wide reputation upon their merits, being made expressly for dynamos and high speed engines. Some of the orders recently entered for the electric double leather belts are for the following stations: American Waltham Watch Company, Waltham, Mass.; Cambridge Electric Light Company, Cambridge, Mass.; Portsmouth Electric Light Company, Portsmouth, N. H.; Newton Electric Light Company, Newton, Mass.; Brunswick Electric Light Company, Brunswick Me.; Gautemala Electric Light Company, Guatemala, C. A.; Framingham Electric Company, South Framingham, Mass.; Belfast Electric Company, Belfast, Me.; Thomson-Houston Electric Company, Augusta, Ga.

The Toronto Industrial Exhibition Electric Railway.

The electric railway to the exhibition grounds in Toronto was again put in successful operation for the two weeks ending Sept. 22. Although the conditions are very exacting, the train of four cars having to run continuously fifteen hours per day, and at an average speed of twenty miles an hour, there was not a moment's stoppage during the entire time. The number of passengers carried was 50,248, so that the affair was a financial as well as an electrical success. The motor and appliances were designed by Mr. J. J. Wright, the manager of the Toronto Electric Light Company, and is the same, with some improvements, as was used on the road last year. The directors of the Exhibition Association, at their annual meeting, presented Mr. Wright with a service of silver plate and a handsomely engrossed address in recognition of the skillful and successful manner in which the electric railway had been operated, and also of valuable help rendered in arranging and managing the electrical effects upon the grounds. The president, Mr. Withrow, in making the presentation, paid a high tribute to the carefulness and skill of Mr. Wright's management, as exemplified in the three seasons' running of the road, when over a hundred and fifty thousand passengers were carried during the limited time allowed, without the slightest accident of any kind whatever.

A Notable Wedding.

The following special telegram of Oct. 2, describes the wedding of Mr. G. B. Prescott, Jr., of the Electrical Accumulator Company, at Pittsfield, Mass.:

The marriage of Mr. George Bartlett Prescott, of New York and Miss Frances Russell Cooley, daughter of William H. Cooley, a prominent and wealthy resident of this town, took place at 12.30 o'clock this afternoon, in the First Congregational Church, in the presence of 600 of the most prominent society people of this town and its vicinity and many friends of the groom from New York. The church was beautifully decorated with palms and potted plants. The ceremony was performed by the Rev. J. L. Jenkins, pastor of the church. The bride, who is about 23 years old, and one of the leading society young ladies of the town, was dressed in white silk, with train of cloth of silver, and wore a tulle veil. Miss Katherine Cooley, the sister of the bride, was maid of honor. There were no bridesmaids. The best man was Joseph P. Schiller of New York. The ushers were Howard Russell Busler, Edward A. Colby, S. C. Baldwin, all of New York; Walter F. Hawkins, of Pittsfield, and Frederick Crane, of Dalton. Immediately after the wedding at the church there was a wedding breakfast at the residence of the bride's father in South street, which was attended by relatives and a limited number of personal friends of the family. The house was decorated with palms and other plants. The presents were very numerous and valuable. Mr. and Mrs. Prescott left town on an afternoon train for Newark, N. J., where they are to reside. W. I. B.

PHILADELPHIA NOTES.

BRANCH OFFICE OF THE ELECTRICAL WORLD,
39 South Tenth Street, Philadelphia, Pa., Oct. 6, 1888.

Personal.

Mr. Brannen, of the firm of Horn, Brannen & Forsyth, the well-known electrolier and gas fixture house, is on a trip to the West in the interest of his firm.

A Co-operative Lighting Company.

A sub-Committee of Councils made a visit last week to the northeastern section of the city for the purpose of familiarizing themselves with the provisions of an ordinance granting permission to the Frankford Avenue Merchants' Electric Light Company to construct a plant for the illumination of stores on that thoroughfare. The company is mainly composed of the tradesmen on Frankford avenue.

Underground Litigation.

In the case of the Keystone Light and Power Company against the City of Philadelphia, in which the Court of Common Pleas was asked to enjoin the city from interfering with the Keystone Company with their desire to dig up the streets for the purpose of laying electric conduits, etc., Judge Allison said last week that the whole affair was in the hands of the Electrical Committee of Councils, and the Court did not like to pass upon the law points until the committee came to some decison in the matter. Judge Allison further said that the Court would not allow the committee to defeat action by remaining quiescent, but if after a reasonable time they did not come to a decision the Court would take it for granted that they refuse the privilege asked for, and would render a decision upon the law of the case.

A Valuable Private Line.

The argument in the suit of Harrison Bros. & Co., the chemical manufacturers, against the Franklin, Atlantic & Pacific and Western Union Telegraph companies, in which it was asked to have the defendants restrained from terminating an agreement under which Harrison Bros. & Co. and four licensees have the priority of use of a private telegraph wire between here and New York, terminated before Justice Bradley, in the United States Circuit Court, last week. The contract was made in 1867, with the Franklin Company, upon consideration that Harrison Brothers & Co. would relinquish a contract which they had with the old Insulated Lines Telegraph Company. It was agreed that the firm should put up a wire at its own expense, to be strung either on the Insulated or Franklin Company's poles. After the expiration of ten years the wire was to be the property of the Franklin Company, and Harrison Bros. & Co. were to have its priority of use, for which privilege they paid a rental of $600 per year. The Insulated Wires merged into the Franklin Company, the latter into the Atlantic and Pacific Company, and afterwards the Western Union became the owner of all those companies. Then, from time to time it was sought to end the arrangement, which had become very valuable to the firm. The Court directed a decree to be entered for Messrs. Harrison Bros. & Co. E. W. E.

WESTERN NOTES.

BRANCH OFFICE OF THE ELECTRICAL WORLD,
44 Lakeside Building, Chicago, Oct. 6, 1888.

La Grange, Ind.

La Grange, Ind., is putting in a central station of 300 Thomson-Houston incandescent lights.

Litchfield, Ill.

The Litchfield Electric Light and Power Company is putting in 35 Thomson-Houston arc lights.

Xenia, Ohio.

The Xenia, O., Electric Light Company, has purchased 25 arc lights of the Thomson-Houston system.

Light for a Furniture Company.

The Tobey Furniture Company, of Chicago, is lighting its building with 25 arc lights Van Depoele system.

St. Paul, Minn.

The St. Paul Gas Light Company, of St. Paul, Minn., is increasing its Thomson-Houston plant with 50-arc lights.

Jacksonville, Ill.

The Jacksonville Gas, Light and Coke Company is increasing its plant with 50 arc lights, Thomson-Houston system.

Aberdeen, Miss.

The city of Aberdeen, Miss., has purchased a 25 arc-light plant of the Thomson-Houston system for lighting its streets.

Albion, Mich.

The Albion Electric Light Company is putting in a Thomson-Houston plant consisting of 60 arc and 500 incandescent lights.

Meridian, Miss.

A plant of 70 arc lights has just been purchased by the Thomson-Houston Electric Light and Power Company, of Meridian, Miss.

Dallas, Tex.

The Dallas Electric Light and Power Manufacturing Company, of Dallas, Tex., is putting in a 50 arc light Thomson-Houston plant.

Light for the Insane.

The County Asylum for the Chronic Insane, of Milwaukee, Wis., is putting in a plant of 150 incandescent lights, Thomson-Houston system.

Toledo, Ohio.

I learn that the City Council of Toledo, Ohio, has passed a resolution to light the city throughout with electric lights, the number of lights to be divided equally between the two local companies.

Brush Plants.

Alex. Kempt, agent of the Brush Electric Company, has just sold a 300-light incandescent plant complete to parties in La Salle, Ill., and an arc light plant to the Studebaker Brothers Mfg. Company, Paoli, Ind.

The Dieckmann Company.

The Dieckmann Electrical Company, of Chicago, has received license to incorporate; capital stock, $100,000; for the manufacture of electric machines and apparatus. Incorporators: G. F. Dieckmann, Christian Wahl and David Quigg.

Streator, Ill.

The People's Electric Light Company is just putting in 600 incandescent lights which they have purchased of the Van Depoele Company, of Chicago. This is the Mayo system, and is the first contract placed by the company since having undertaken the manufacture of that system.

Personal.

Mr. J. E. McConnell, superintendent of the H. B. Cox Electric Company, of New Haven, Conn., has been in the city for some days in the interest of his company.

Mr. John Dick, manager of the Phœnix Iron Works (limited), Meadville, Pa., paid Chicago a flying visit this week. He reports that his company is very busy in the construction of the Dick & Church high speed engine for electric light stations.

Mr. F. S. Terry, manager of the Electrical Supply Company, returned from the East this week, and reports having had a pleasant trip.

Mr. A. K. Stiles, general manager of the Van Depoele Electric Manufacturing Company, returned this week from his trip East for a stay of a few days.

Electricity in Iron Mining.

The Chicago *Journal of Commerce* of recent date contains the following:

"An application of electricity to iron mining is now proposed. It consists in the crushing of magnetic iron ore by crushers and rolls, and effecting a separation of the ore from the gangue by means of dynamos. An experimental plant is to be erected at one of the Marquette mines, and the machinery best adapted for work on a large scale tested. With the large waste rock piles of magnetite on that range, a due regard to economies and fair prices for ore, it is thought that there should be developed a paying business of handsome proportions."

The Heisler System.

The Heisler Company, of St. Louis, reports as follows: The central station, Grand Junction, Colo., will be, as reported by our general agent, Mr. Keelber, in operation in a few days. Our constructing electrician will then leave for Pueblo, Colo., where we are erecting a large central station plant for the Gas Company in that city. The Merced central station plant, under construction for the Merced Gas Company, Cal., will be completed and started in a few days. This order is very gratifying. Mr. Swain, their superintendent, has awarded the contract to the Heisler Electric Light Company, after having made a personal and thorough investigation of the working of all others as well as of the Heisler system, of Salt Lake and Ogden, Utah. An additional large order of 600 lights is reported from the Eugene City Electric Light Company, Ore., whose Heisler plant was erected last year.

Street Lighting by Electricity.

Just now Prof. Barrett, city electrician, is engaged in rearranging the wires in the Washington street tunnel in order that Mr. Yerkes may proceed to line the hole with steel sheeting. The professor is also placing cables in the conduits to supply the electric lamps for street lighting. Before the new year he expects to have lines in operation on Madison street, from Ashland avenue to the lake; on Michigan avenue, from Rush to Jackson street; on Halstead street, from Van Buren to Randolph; on Van Buren street, from the bridge to Halstead; on Desplaines street, from Van Buren to Washington, and on Washington street, from Halstead to the tunnel. These are trunk lines, and will be operated by the new plant at the corner of Desplaines and Van Buren streets. Prof. Barrett thinks they will be in use by Nov. 1. As fast as money can be obtained he will construct spur lines and light other streets. There will be two lamps at street intersections and one in the middle of each block. The lamps will be 14 feet above grade, the posts being of symmetrical pattern, designed in the engineer's office, with an iron base and wooden standard.

Electrical Engineering in the West.

One of the busiest firms in the West is undoubtedly the Pond Engineering Company, of St. Louis and Kansas City, engineers and contractors for complete steam plants for all purposes. They now have the following orders on their books for Armington & Sims engines: One 75 and one 125 h. p. for the Pine Bluff, Ark., Water and Light Company; one 75 and one 125 h. p. for the Fort Scott, Kan., Electric Light and Power Company; one 42 h. p. for the Metropolitan Street Railway Company, Kansas City, Mo.; one 75 h. p. for the Bank of Commerce Building, St. Louis; one 30 h. p. for the County Court House, St. Joseph, Mo.: one complete steam plant of 200 h. p., including steel boilers, engines, heaters, pumps, etc., for the Little Rock, Ark., Edison Electric Light and Power Company; one 100 h. p. steam plant, complete, for driving the new Sprague electric railway at Asheville, N. C. This power plant is an addition to the works of the Asheville Electric Light Company. The Pond Company are also furnishing a 125 h. p. Armington & Sims engine to the Edison Illuminating Company, Topeka, Kan. They have also been awarded the contract for the erection and starting of the 600 h. p. plant, for the new central Edison station at Kansas City, Mo. They are furnishing a 400 h. p. Hoppes purifier to the electric railway between Council Bluffs and Omaha. They have just supplied two 80 h. p. steel boilers to the Crawfordsville, Ind., Gas and Electric Light Company, and the same to the Jacksonville, Ill., Gas Light and Coke Company. Besides the above, they are very busy in other departments.

Arcade Rapid Transit.

A company known as the Arcade Rapid Transit Company has for some time contemplated the construction of an underground road from Michigan avenue to the city limits. The company was incorporated about two years ago, but for various reasons its scheme has been allowed to sleep, and none of the men who were then connected with it have anything to do with it at present, the originator of the scheme having died. The president of the company is Joseph Sears; vice-president, J. Frank Aldrich; secretary and treasurer, Jos. R. Putnam. From Mr. Putnam, the secretary of the company, I learn that the company is now getting in a position to commence the construction of this road as soon as the ordinance has been obtained from the Council and other matters arranged. Mr. Putman thinks that the Monroe street line has many advantages over that of any other route, as it has been found that there are no sewers to be interfered with in the excavation. It is proposed to go but a short distance below the surface, and this will enable them to keep it well aired and free from water, and besides it can be made as light as day by means of electric lights. It is claimed that the excavation will not interfere at all with foundations of buildings, as it does not go below the foundations of most buildings. The motive power to be used has not been decided upon, but Mr. Putman thinks that they are favorably inclined towards cable or electric motor.

It would seem that here is a most legitimate place for the electric motor, as it would be noiseless and cleanly. Gen. Wm. Sooy Smith, an eminent engineer of national reputation, who is in the city at the present time, expresses an emphatic opinion that this scheme is entirely feasible, and that of all methods of securing rapid transit the subway is comparatively the best.

Chicago Electric Club.

A regular meeting of the Chicago Electric Club was held Monday evening of this week. There was a fairly good attendance by the members, considering that it was the first meeting of the club after the summer vacation, and the fact that a number had the impression that the meeting would occur on the evening of the 8th instead of the 1st, not receiving notice to that effect. President Barton was in the chair. Mr. C. A. Brown was to have read a paper on "The Electrical Interest and the Tariff," but at his request the reading of it was postponed until the next meeting. The committee appointed some time ago to look up the matter of securing new club rooms made a report to the effect that they had made a pretty thorough canvass in various parts of the city but had not succeeded in deciding on anything definite. The most satisfactory of anything which presented itself to the committee was the taking of a private house on Harrison street and remodeling it to suit the convenience of the club. The matter was discussed by members of the committee and the club, and the universal opinion was very much in favor of new quarters of some kind, but the matter of location does not appear to be an easy matter to decide, although the preponderance of testimony brought out by the discussion seemed to be in favor of going into the residence portion of the city and securing quarters large enough to have rooms to accommodate the "bachelor members" of the club who might desire to secure permanent rooms. A report of the membership committee showed an increase in membership during the past few months. President Barton spoke upon the present status and the future of the club in an earnest and happy manner, and was warmly applauded by the members of the club. While it was fitting, he said, that New York should perhaps have the first place in the matter of electrical clubs, he thought Chicago should, at least, have second, and might take first. In his opinion telegraph men, telephone men and the class of people interested in electrical development should be brought into the club. In this way the club would gain strength, and he thought it would be only a question of time when the club should have its own club house. Mr. S. A. Duncan, of Pittsburgh, President of the National Electric Light Association, was present, it being the first meeting of the club he has been able to attend, although one of its members for some time. He was received by kindly applause from the members. In response to an invitation from President Barton, he made a few well-chosen remarks about clubs in general, and said that it was a significant fact that the club was keeping pace with the development of other electrical enterprises. As a matter of fact, he said, with possibly a few exceptions, there were few clubs to be found in the business portion of the city. These were founded for political purposes, and had a great following in respect to members and money. The residence portion of the city would, to his mind, be more desirable for the location of the club. The club adjourned for two weeks. E. L. P.

SOUTHERN NOTES.

DALLAS, Texas, Sept. 19, 1888.

Greenville, Tex.,

Will soon rejoice in the electric light. The common council having recently granted the Electric Light Company the franchise and right of way, it is expected that work will be begun at once.

Personal.

Mr. F. D. Richards, formerly agent of the Thomson-Houston Company for this State, but now of the Ft. Wayne Jenney Company, is faithfully looking after the interests of his company throughout the State.

Good Linemen Scarce.

The Erie Telephone Company have not yet completed their labors, and the work of reconstruction still goes on, and it looks as if it was destined to continue, as they daily advertise for good linemen, there being a scarcity in Dallas at present, the various companies absorbing them the moment they arrive here.

The Edison System.

Mr. W. T. D. Mottram, the popular agent of the Edison Company, is doing yeoman service in Texas. In addition to the large increase sold to the Electric Light, Power and Manufacturing Company, he closed a contract last week for Weatherford, Tex., for a 600-light plant, three-wire system, also a 150-light isolated plant to the State Reformatory at Gatesville, Tex.

Lighting in Dallas.

Electric light matters are unusually active in Dallas at present. The Electric Light, Power and Manufacturing Company has a large force at work setting the engines and otherwise installing its new plant under the efficient management of Mr. Seth Miller, its president and general manager. It is expected that the entire reconstructed plant will be in operation Oct. 1. They also have the contract for the lighting of the grounds and buildings at the Texas State Fair and Dallas Exposition, and will be completed there in a few days.

The Queen City Company.

The Queen City Company began operations some time since, but matters have only assumed definite shape in the last few days. They have a very large force at work, and poles and wires are going up in all directions. From present appearances they will have their arc circuits in operation Oct. 1, and possibly a few incandescents. But little effort is being made in that direction. They have a large list of subscribers, and the outlook is very promising. There is a movement now on foot to have the three principal streets lighted during the coming fair, and possibly the side streets. As each street from the river to the fair grounds is a trifle over three miles long, the illumination will be a grand success, and no one will have cause to complain of poorly lighted streets.

The State Fair.

The coming Texas State Fair and Dallas Exposition will be of greater dimensions than ever before. Electricity and its various applications will be an important feature this year, and will afford the numerous manufacturers of electrical appliances a most excellent opportunity to bring their different articles to the notice of the people of Texas, Mexico and the Southwest generally. In addition to the lighting of the grounds and buildings by a 600-light Edison plant and a 60-light arc, there will be a number of exhibits entirely electrical in their character. The Brush Company will have an exhibit of their dynamos, lamps, motors and other parts of their system. The Sprague Company's interests will be looked after by Mr. Mottram, who will have a number of motors in operation. The Baxter Motor Company will have a large exhibition of their various motors under the management of the able representative of that company, Mr. F. R. Colvin. They will also have a large number running exhibits supplied by current from the E. L. P. & Mfg. Co. Clower & Harris will have an extensive exhibit of electrical goods, and are making special efforts to have the largest display of electrical apparatus this part of the country has ever witnessed. They will also exhibit the well known Crowdus electric fare box and batteries, which, by the way, were invented by a former resident of Dallas. Electrical manufacturers throughout the country should make it a point to have something there to show Texas and this part of the country what is being used in electrical fields.

BIRMINGHAM, Ala., Sept. 24, 1888.

Lighting of Aberdeen, Miss.

The Thomson-Houston Company have closed a contract for the sale of a 25-light arc plant to the city of Aberdeen, Miss.

A New Station at Bessemer.

The Bessemer Electric Light and Power Company have started their Excelsior plant of 35 arc lights in temporary quarters. A new station is being built for its reception, and is now nearly completed.

The Gas Company's Plant.

Work is steadily progressing on the addition to the plant of the Birmingham Gas Light and Illuminating Company. The capacity of the present plant of 200 arc and 800 incandescent lamps of the Thomson-Houston system will be about doubled.

Sprague Motor Replacing a Gas Engine.

The Southern District Telegraph and Electric Company, of Birmingham, Ala., have sold to C. E. Roberts for his printing office a 5 h. p. Sprague motor. The motor will replace a gas engine now running the presses in Mr. Roberts' establishment.

Isolated Plants.

The Edison Company's installation at the University of Alabama, at Tuskaloosa, is nearly completed.

Mr. E. G. Stevens, of Birmingham, has contracted with W. C. Harris, Jr., for a 12-light arc and 60 series incandescent plant of the Waterhouse system.

Effects of Yellow Fever.

The presence of yellow fever in the South bids fair to seriously interfere with the electrical business in this section. The quarantine regulations seriously impede travel, and although the spread of the fever up to the present time has been checked thereby, there is a probability of a continued advance until cold weather.

A New Lighting Company.

A stock company has recently been formed for the lighting of the South Highlands (the residence portion of Birmingham). Dr. H. M. Caldwell, A. W. Fuller and others are incorporators, with A. W. Fuller as manager and electrician. The plant now in use, consisting of 30 arc and 300 incandescent lamps of the Brush system, will be enlarged by two 30-light Waterhouse arc machines. The steam plant will comprise one 60 h. p. Ball engine and a 100 h. p. Westinghouse.

ENGLISH NOTES.

LONDON, Sept. 26, 1888.

The Atlantic Cable Rates.

The accounts so far as they are made public relating to the working of the Atlantic cable lines under the increased tariff since the 1st inst. are highly satisfactory to the companies, and hardly less so to the public. The number of messages is said to have but slightly decreased, and, of course, the receipts have greatly increased, seeing that the rate has been doubled. Users of the cables acquiesced in the change without a murmur; it had long been seen to be inevitable, and as the wires are a little less crowded, messages are got through with greater dispatch. Of course, there may be a diminution of the number of words signalled without any proportionate reduction in the quantity of messages transmitted, and it is too soon to argue that the profits under the 6d. tariff will be doubled under the 1s. tariff, nevertheless they are tending in that direction, and as the press has been deprived of some of its unremunerative privileges, and the continental cables will soon be in the hands of the government, working at reduced rates, which will help to feed the Atlantic cables, the prospects of the latter are decidedly more promising than they have been for many years past.

The Electric Sugar Refining Company.

An influential meeting of shareholders in the "Electric Sugar Refining Company" has just been held to hear from Mr. Roberts, of Birmingham, who is one of the largest shareholders in the concern, a report of what he had witnessed at the trials of the process in New York. Mr. Roberts' account was received with much satisfaction and apparently without misgivings. So far as we can gather, however, he knows no more about the mode of operation than the rest of his friends in Birmingham—a place more famed for its knowledge of brass buttons than of sugar refining. The news that he brings from your side of the water is that standing at the bottom of a factory two or three stories high he saw sugar descend several spouts in more or less perfectly refined condition, while the rumble of machinery—presumably electric—was shaking the building. He was assured that a "Mr. Howard and his wife" were pouring raw sugar into the hoppers on the top floor, and he was satisfied that what he saw on the ground floor was the same article, only electrically refined. When the plant now in construction is completed it will turn out 5,000 barrels a day, provided—for there seems to be some such conditions attached to success—a sufficient number of Mr. and Mrs. Howards can be found who will not only pour in the sugar, but keep the secret. Perhaps you are better informed as to this extraordinary business than we are here. All that we can say about it with any degree of confidence is that the shares of the company have gone up to a fabulous figure, and that a certain number of persons actually do hold shares in it—persons who will be alike fortunate whether they sell at present prices or get their cent. per cent dividends a few months hence.

The Discussion on Lightning Conductors at Bath.

The recent discussion on the theory and practice of lightning conductors carried out conjointly by sections A and G of the British Association has naturally attracted great attention, not only in electrical circles, but in the daily press and elsewhere. The general attitude of "practical men" toward Dr. Oliver Lodge's experiments and the deductions he draws from them is summed up in a remark made by Mr. W. H. Preece in his opening speech at Bath. "If a lightning protector raised above a building," said Mr. Preece, "did *not* protect the area around and about that building, what earthly use was there in the lightning protector?" which is doubtless magnificent, but scarcely argument. In short, practical men are somewhat indignant with Dr. Lodge for so ruthlessly disturbing the neat geometrical protected area of the Lightning Rod Conference of 1878, and the other dogmas proclaimed by this ecumenical council of practical electricians. As for the daily press, its grievance seems to be that after all the recent advances in scientific knowledge and after all the expenditure of money on lightning rods, the leading lights of the electrical world should be so much in the dark as to the best way to protect buildings from lightning. The public may, however, lay this flattering unction to their soul, that in spite of Dr. Lodge's somewhat sweeping condemnation of the present system of protection from lightning, the conductors, as at present constructed, have, time after time, performed their functions effectively, and that, therefore, there is probably some ground for the contention of the practical men that Dr. Lodge's experiments were not strictly analagous to natural lightning discharges. Mr. Preece, in opening the discussion, carefully took up a pretty safe position, the proposition which he engaged to defend being that "there is no authentic case on record where a properly constructed conductor failed to do its duty." From this position Mr. Preece proceeded to overwhelm his opponent, not only with argument, but with the results of the ever memorable "Lightning Rod Conference," and with several jeers at the many unfulfilled predictions of mathematicians. However, in asserting that lightning flashes, "if they were analogous to anything in a Leyden jar were analogous to the bursting of the dielectric and not to the external discharge," Mr. Preece certainly hit a weak point in Dr. Lodge's experiments. He also laid great emphasis on the magnetizing and electrolytic power of lightning flashes as tending to disprove "the beautiful theory of the oscillatory character of a lightning flash;" but as Lord Rayleigh and Sir Wm. Thomson subsequently showed, this contention was rather wide of the mark. Mr. Preece concluded his spirited attack by remarking that whatever the outcome of the debate, "at all events it would have this advantage, that it would bring to their minds, what they were all anxious to have brought before them, the true theory of electricity." Dr. Lodge replied with considerable effect, and though he was obliged to confess that the position taken up by Mr. Preece was impregnable, he pointed out that it was also one nobody dreamt of attacking. However, conductors had been known to fail, notably, quite recently, at the Hotel de Ville at Brussels, but of course it was possible that that was not properly constructed, though M. Melsens had spent much time and trouble on it, and the Brussels Hotel de Ville was generally quoted as the best protected building in the world. Lord Rayleigh said he felt that "mathematician" was becoming almost a term of abuse, and then proceeded to show that most of Mr. Preece's jeers at the "genus mathematicus" were unfounded, as the particular unfulfilled predictions quoted were those of eminently practical men. With regard to the magnetizing effects of oscillatory currents, Lord Rayleigh said they might possibly be explained by the circumferential currents induced in the iron itself by these discharges. These circumferential currents would at first at any rate protect the interior of the iron from direct magnetizing effect. In conclusion Lord Rayleigh aptly remarked that "the laboratory experiments must be most important as suggestions, but he thought no one would wish finally to adopt any system or to change any system of lightning protection without actual experience upon a large scale." Sir Wm. Thomson said he thought that Dr. Lodge was in the American stage of inertia, namely, resistance to stopping, while Mr. Preece was in the English stage, namely, resistance to motion. He thought a good deal more experimental investigation was desirable before iron was substituted for copper. He thought what Dr. Lodge had put before them justified them in saying that an iron building would be as safe as safe can be. This appeared to him "a somewhat important practical conclusion which might safely be drawn from the consideration of these electrical oscillations and the experiments regarding them, and the trials for a mathematical theory of them, mathematical calculations of which they had heard so much." Prof. George Forbes, Sir James Douglass, the Hon. R. Abercromby, Mr. G. J. Symons and others also took part in the discussion, which bids to be *the* electrical discussion of the year.

BATH, Eng., Wednesday, Sept. 12, 1888

The British Association.

The meeting of the British Association at Bath, which has this day been brought to a conclusion, although highly successful as a social and scientific *fête*, has not been marked by the announcement of any brilliant scientific discovery or of any surprisingly novel invention, such as are recorded now and again in its earlier annals. The fact is that men can no longer afford "to save themselves" for the British Association. New theories, experiments, or inventions are now-a-days described as soon as made—too soon sometimes—either before one of the learned societies or in the columns of the technical journals. The British Association is in consequence reduced to play a less striking—but possibly after all a more useful—part, by affording opportunity for the meeting, on common ground, of the great army of workers in the varied fields of science; and also by means of its numerous sections

committees in planning and carrying out such researches as by reason of their importance, their difficulty, or their laborious character, it is desirable to stamp with an authoritative seal. Such, for instance, is the historical committee on 'electrical standards which was appointed in 1863 (the year before the association last visited Bath), and which is still continuing to do useful work.

In this letter, however, which exigencies of space and time demand to be but short, I will devote my attention to the papers on the applications of electricity which were read in Section G, and later I may have something further to say about the more purely scientific proceedings in Section A, which is devoted to mathematics and physics. The list of papers on electrical subjects read in the mechanical section is a very brief one, and although some important questions were dealt with, it can scarcely be said to include anything of superlative interest. These papers were nine in number, and taking them in the order in which they were read, we have, first, Mr. W. Anderson "On a 20-ton Traveling Crane Worked by Electricity," which is in use in the foundry at the Erith Iron Works. Probably you have printed the paper when this reaches you.

The next paper is one by Mr. R. E. Crompton "On the Cowles Process of Electric Smelting." The process having originated on your side of the water I need not volunteer any detailed account. The works erected at Stoke-on-Trent in Staffordshire are now in full swing, and the Crompton dynamo of 60 volts and 5,000 ampères is working satisfactorily.

The next paper is one which drew a crowded audience, by Prof. George Forbes, on "Electric Lighting in America." The professor confined his remarks chiefly to the Westinghouse system, and it was evident that the non-electrical members of the section were greatly astonished at the facts and figures which were so graphically placed before them.

Mr. Henry Edmunds next described his singular system of electrical distribution by means of secondary batteries.

Mr. W. Lowrie read a paper on his alternating current meter, which is in use at Eastbourne. This device is simplicity itself. He takes a constant cell and a depositing cell and places them together in series with the secondary coil of the transformer. Now the net current passing in one direction through the depositing cell obviously depends upon the number of lamps in circuit. The alternating current itself has, of course, no influence whatever on the rate of deposition, which depends solely on the number of lamps. The objection is that unless large cells are used there will be a waste of energy in sending two alternating currents through the two cells, and there will also be a temperature error. However, in practice the arrangement appears to give satisfaction. The four remaining papers scarcely require detailed notice, for although the subjects are interesting, they contained very little that has not already been made known. The titles are as follows: "The Navigation of the Suez Canal by Electric Light," by Mr. R. P. Sellon; "Electricity as Applied to Mining," by Mr. F. Brain; "Miners' Electric Safety Lamps," by Mr. N. Watts, and "An Automatic Fire-Damp Indicator," by Mr. J. W. Swan.

In concluding this letter I must not omit to refer to Prof. W. E. Ayrton's highly successful lecture on the "Electrical Transmission of Energy," which was delivered to a delighted audience filling to overflowing the largest hall in the city. So great was the interest taken in the lecture and the experiments by which it was illustrated that Professor Ayrton has been requested to repeat the performance to-morrow evening, chiefly for the benefit of workingmen, to whom nominal prices of admission will be charged. The lecture was delivered in the Professor's happiest vein and sparkled with wit and humor throughout. At least one of his epigrams will be of special interest to your readers. "Inertia," he said, "has two definitions—in America it means resistance to standing still, but in this country it means resistance to motion." The experiments on electric welding carried out by Mr. Fish, of the Thomson-Houston Company, were highly successful and attracted very great attention.

THE TELEGRAPH.

Fire Alarms.—The Brooklyn Auxiliary Fire Alarm Company has been formed by H. O. Simmons and others with a capital stock of $300,000.

Louisville, Ky.—The Gaynor Electric Company have been awarded the contract to furnish the Louisville Fire Patrol Company with a fire-alarm system.

South America.—The Mexican Telegraph Company has declared a dividend of 2½ per cent., and the Central & South American Company a dividend of 1¾ per cent., both payable on Oct. 1.

Hain's Telegraph School.—There is trouble between Col. Hain of the elevated road in this city and his telegraph operators, because he proposes to re-establish the telegraph school at Chatham Square station.

Interstate Telegraphs.—The Postal Telegraph Company has applied to the Interstate Commerce Commission for help in securing access to the wires on the Pacific Railroads, on which the Western Union has enjoyed exclusive privileges.

A Big Telegram.—The *Herold*, of Milwaukee (German), obtained the first copy of the *Deutsche Rundschau*, containing the Tagebuch of the dead Kaiser Friedrich, which reached New York on Monday, and had the same telegraphed verbatim in German 22,150 words in time for Tuesday morning's edition. This feat stands unparalleled in the history of American telegraph companies as far as the transmission of so large a special in the German language is concerned.

Rapid Cabling.—Mr. W. F. G. Shanks tells the following in the N. Y. *Times:* Mr. Abbey did volunteer one statement of interest in illustration of the facilities for business which the commercial world is afforded by bankers and cables. "One day this summer," he said, "I was in Eisenbach, Germany, trying to close with Hofmann. Mr. Grau was in Buenos Ayres. A principal artist we were negotiating with was playing in London. Mr. Schoeffel was in New York. On a Monday Mr. Grau transmitted by cable a very large sum via Europe to New York. On Tuesday I returned to Hamburg, where I found a telegram from the artist in London asking me to transmit $12,000 to an agent in Paris to close the contract. I had to ask this agent's address. While waiting for it, a telegram from Mr. Schoeffel told me that the Buenos Ayres remittance was to our credit in New York. The Paris agent's address came to Hamburg Tuesday night, and on Wednesday morning $12,000 of the Buenos Ayres remittance to New York was paid to him in Paris, and a receipt mailed to me in Hamburg."

THE TELEPHONE.

Norfolk, Neb.—Gen. Barney states in his telephone bulletin that Norfolk is to have an exchange with a capacity of 250 instruments, and that the work is in hand.

Stanley's Stress Tables.—Mr. T. B. Doolittle, the well-known telephone expert and special agent of the American Bell Telephone Company, writes us as follows: "Mr. H. D. Stanley, of the Bridgeport Brass Company, has again placed the electrical fraternity under obligations to him for the appearance of a pamphlet entitled 'Stress Tables.' For this and kindred works emanating from the same source, and which must have involved a vast amount of patient labor, Mr. Stanley is already fully appreciated." We agree thoroughly with Mr. Doolittle in this tribute to Mr. Stanley's excellent work, of which we made note at the time of the telephone convention.

THE ELECTRIC LIGHT.

Dalton, Ga., is to have a Thomson-Houston plant.

Dyersburg, Tenn., proposes to have an electric light plant.

Terrell, Tex.—It is said that the asylum at Terrell will put in a plant.

Newark, Del., is to have a water-works and electric light combination plant.

Augusta, Ky., has a stock company organized to erect an electric light plant.

Ocean Grove, N. J., is being furnished with a large central station Heisler plant.

Anniston, Ala.—It is said that the Anniston City Land Company proposes to add a dynamo to its present lighting plant.

El Paso, Tex.—The El Paso Electric Light Company has been formed by J. J. Gardson and others with a capital stock of $50,000.

Maysville, Ky.—The Maysville Gas Company have bought out the Citizens' Gas Company, and will erect an electric light plant.

Buffalo, N. Y.—The contract for lighting the new Richmond Hotel at Buffalo has been awarded to the United States Electric Lighting Company.

Greensboro, N. C.—The Greensboro Gas and Electric Light Company have purchased a controlling interest in the Greensboro Electric Light Company.

Biddeford, Me.—The Biddeford and Saco Light and Power Company has been formed by L. A. Bachelder and others with a capital stock of $75,000.

Syracuse, N. Y.—The Jordan Electric Light and Power Company has been formed by F. H. Leonard, Jr., and others with a capital stock of $10,000.

Boston, Mass.—The Boston Electric Light Company has declared a quarterly dividend of 1½ per cent., payable Oct. 15, to stockholders of record Oct. 1.

The Heisler System.—New contracts for stations are in course of execution at Greenport, N. Y., and Yonkers, N. Y., the plant in the latter case being quite large.

Williamsburg, N. Y.—The Williamsburg Electric Light and Power Company, of Brooklyn, has been formed by P. W. Aims and others, with a capital stock of $300,000.

Wilmington, Del.—The Wilmington City Electric Company has the contract to light the city for three years with 25 arc lights of 2,000 c. p. at 45 cents per night per lamp.

Amsterdam, N. Y.—Yunds, Kyne & Kennedy, Amsterdam, N. Y., have recently increased their Brush incandescent plant by purchasing a 225 light dynamo from the parent company.

Calumet, Mich.—The Culumet & Hecla Mining Company recently increased their electric light plant by purchasing a number of 2,000 c. p. arc lamps from the Brush Electric Company, of Cleveland.

Carlinville, Ill.—The Electric Light Company, of Carlinville, Ill., have recently increased their Brush arc plant by purchasing through Mr. Alex. Kempt, the Chicago agent, two 150 light incandescent dynamos.

Profit and Loss.—"There's no loss without some gain," sighed the lamp-post as it pensively observed itself supplanted by the electric light, and became a simple supporter of business cards and hands that "point the way."

Greenville, Tex.—The Greenville Water and Electric Light Company, incorporated by J. M. Cook and others, with a capital stock of $100,000, begins operations this month, and will be ready for business next May or June.

Ohio.—Mr. Frank Tooker, representing the Jenney Electric Company of Indianapolis in Ohio, has during the past month made the following sales: To the Cosbocton Gas and Electric Light Company., a $12,000 plant (arc apparatus); to the Sidney Gas Company, a $7,500 light outfit, and to Wm. Peter, of Columbiaville, a 300 incandescent and 35 arc light outfit.

The National Electric Company.—Steps have been taken to incorporate the National Electric Company, with Henry P. Gilbert, George Gill, Jr., and others, of Washington, and George W. Wilson and James S. Humbird, and others, of Pittsburgh, Pa., as incorporators. The capital stock is $250,000, of which 20 per cent. is to be paid in in cash within 60 days. The object is to establish electric plant for lighting, motive power, etc.

Newburgh, N. Y.—The Edison Electric Illuminating Co., of Newburgh, N. Y., have just completed several important changes in the arrangement of their electrical apparatus, and have laid another feeder from their station to supply the new Academy of Music with light and open up a new territory to the Edison light. This new feeder was laid underground, using the Edison tubes, and gives excellent results, the completed length, 1,750 feet, having an insulation resistance of about six megohms. The work was done under the charge of Mr. Wilson S. Howell, of New Brunswick, N. J.

Automatic Lamp Regulation.—Two small boys and a scraggy dog were regarding intently an electric light pole on Broadway from which the evanescent blaze had vanished. "Hi, Johnny, de light's gone out." "Dat's nodin; something's on the wire. Here, we'll get it off," and the boys began to wear out the toes of their shoes on the pole, the scrawny dog barking the while vigorously. Presently the light began to "come." The carbon glowed red, then became brighter and brighter until the full blaze was resumed. "I tell you so," said the first boy, "dat's de way to 'bring' 'em round. See?"—*Buffalo Courier.*

The Storage Battery Saved.—For some time past Mr. Charles Toppan, of Salem, chemist of the Canton Manufacturing Company, has been experimenting with a new compound for keeping alive storage batteries. He has used an old, worn-out battery four weeks without any perceptible diminution in power. A few days ago he made a most successful experiment with the electric light at his home in Salem, among the witnesses being Sir Lyon Playfair, Hon. Edward Atkinson and others. After a 2,000 candle-power arc light had been shown the current was shut off, and Mr. Toppan heated the carbon with the liquid which he has discovered, and the current was turned on again. The light was increased three times in brilliancy. Other experiments were made with telephone batteries by injecting a zinc compound into them. Mr. Toppan has also discovered a compound believed to be effectual in cases of snake bite.—*Boston Herald.*

APPLICATIONS OF POWER.

Ottawa, Ill., expects to have its Thomson-Houston road running by December.

Norfolk, Va.—The Norfolk Electric Power Company has incorporated, with G. E. Bowden as president.

Baltimore, Md.—The Catonsville Horse Car Company contemplates the use of electricity as motive power.

Manchester, N. H.—Permit has been granted the Manchester Horse Railroad Company to operate by electricity.

Huntington, Va.—The power plant of the Huntington Electric Light and Street Railroad Company will be put in by the Hill Clutch Works.

New Orleans, La.—Mr. W. Oswald, agent for the Sprague Company, has sold another 5 h. p. motor to run an elevator. He has established headquarters at 112 Baronne street, where he occupies the whole ground floor.

Akron, O.—The Sprague road at Akron, O., has gone into successful operation. It is over 6½ miles long and will have an initial equipment of 12 cars. The owners of the road are fully pleased with it. The Sprague system was adopted at Akron after a committee of the city council had investigated the subject of electric railways and had visited various roads.

The Electrical Road at Davenport, Ia.—The Sprague electric railroad at Davenport, Iowa, has been running very successfully ever since its installation, and the President and Directors of the road express themselves as being very well satisfied with its operation. This is the only electrical road in the State of Iowa, and the cars are filled with a great many passengers who are curious to try the new motive power.

Sprague Roads.—The Sprague Company now has electric railroads in operation or building in the following cities: Richmond, Va.; Erie, Pa.; Reading, Pa.; Wilkesbarre, Pa.; Wilmington, Del.; Harrisburg, Pa.; Lafayette, Ind.; Carbondale, Pa.; Steubenville, O.; Boston, Mass.; Cleveland, O.; St. Joseph, Mo.; Asheville, N. C.; Salem, Mass.; Brockton, Mass.; Davenport, Ia.; Hartford, Conn.; Scranton, Pa.; Akron, O.; Manchester, Va.; Sandusky, O.; Minneapolis, Minn.

San Jose, Cal.—Reports from San Jose speak very highly of the success of the Fisher electric railway, which has gone into operation there, the system used being that invented by Mr. Frank E. Fisher, the manager of the Detroit Electrical Works, who has been in San Jose for some time superintending the construction of the road. The line is five miles long, double track, and the conductors are carried in a light concrete conduit within which a trolley makes contact. The plant includes two dynamos, a Wheeler engine of 100 h. p. and a Hazelton upright boiler of 125 h. p. Three or four cars are running, and the patronage of the public is something enormous. Several leading citizens of San Jose are interested in the road, and the newspapers, without exception, are enthusiastic as to its operation.

PERSONALS.

Mr. Charles H. Avery.—Cards have been issued for the wedding of Mr. Charles H. Avery and Miss M. Metcalf, at Varick, N. Y., on Oct. 17.

Mr. George Ticknor Curtis has an interesting article in the New York *Sun* of Sept. 30, in advocacy of the establishment of the Court of Patent Appeals.

Mr. W. C. Bryant, for nearly four years superintendent of electric lighting at Waterbury, Conn., has resigned his position and will shortly open headquarters at Bridgeport for the sale of general electric supplies.

Mr. E. A. Stevenson, a well-known official of the Telegraph Construction and Maintenance Company, of England, who has recently been in Nova Scotia in connection with repairs of the Direct United States Cable, paid a visit to this city last week, to call upon his son, who is also in the electrical profession.

Mr. W. H. Randall, the active representative in the East of the supply department of the Thomson-Houston Company, spoke very hopefully while in New York last week of the outlook in the electrical field for the coming winter. The demand for arc and incandescent lamps, carbons, motors, wire and machines was larger than it had ever been, and new consumers cropped up daily. He reports that there is already an active inquiry for welding apparatus.

Mr. J. H. Wade.—Every now and then some old characters drift into Wall street whom very few people of this generation know, and yet they have had more to do with the business of Wall street than hundreds of those who are in it to-day. Jephtha H. Wade, of Cleveland, dropped into the office of a banker the other day to ask for some information, but no one knew him. They did not recognize the man who, as much as any one else, was responsible for stretching the Western Union wires across the continent, and who, more than any one else, with the possible exception of Amasa Stone, built up the railroad system of Ohio. Mr. Wade is now a white-haired man of more than seventy, wearing the traditional black frock-coat, and looking very much like a staid, respectable citizen from the interior.—*N. Y. World.*

MISCELLANEOUS NOTES.

Chattanooga, Tenn.—Dorsey, Paine & Co. intend to rebuild their works, recently destroyed by fire.

Montreal, Can.—The Hibbard Electric and Manufacturing Company, in Montreal, Can., has been organized with a capital of $150,000.

The Johnson Electric Supply Company, of Portland, Me., has been incorporated by R. L. Walker and others, with a capital stock of $250,000.

Electro-Plating.—The United States Plating Company, of Kittery, Me., has been formed by H. R. Thompson, of Newton, Mass., and others, with a capital stock of $100,000.

The Woodman-Clark Cell.—Dr. Durand Woodman has issued a neat circular with regard to the above cells, with which such good results have been obtained as standards, as reported by Mr. A. E. Kennelly and Mr. J. W. Howell.

The Barrett Battery.—The John A. Barrett Battery Company has been incorporated at Baltimore by Charles Willms, Claude Van Bibber, George Franke, R. B. Barrett and Daniel Maier, with a capital stock of $75,000, to manufacture batteries.

The Signal Service.—Second Lieutenant B. M. Purcell, Signal Corps, has been ordered to visit signal stations in Dakota and Montana; First-Lieutenant Robert Craig, Fourth artillery, to visit signal stations in Pennsylvania, Ohio, Michigan, Minnesota, Iowa, Maryland and Virginia; Second-Lieutenant R. B. Watkins to visit stations in Missouri, Kansas, Nebraska, Iowa and Illinois; Second-Lieutenant John C. Walsh to visit Indiana, Illinois and Tennessee.

Execution by Electricity.—The law in New York State requires that after the first day of January next the death penalty shall be inflicted by electricity. It is left to the sheriff to provide the means, and it will be the duty of the new sheriff, should he have any criminals to execute, to decide what electrical apparatus to use. A committee of the Medico-Legal Society has been making some experiments on the subject, and is still engaged in preparing a report which will soon be submitted. The committee consists of Dr. Fred. Peterson, Elbridge T. Gerry, Prof. R. O. Doremus, Dr. Frank H. Ingram and Dr. J. M. Bleyer.

Dangerous Mineral Water.—Reports come from Sonora, Cal., of a remarkable manifestation of magnetism there. While a prospecting party was out on Mt. Lyell recently they discovered a big reef of mineral which resembled manganese and chrome iron; when a young man of the party was unable to move from the spot until the sun went down, at which time he re-assumed government of himself. The newspaper which tells this wonderful yarn says that the theory is that the young man had been drinking too much mineral water, which was highly impregnated with iron and copper, and hence was unable to resist the magneto-electric influence of the mineral zone on which he found himself. This is a pretty good story.

BUSINESS NOTICES.

Jordan & Gottfried, 208 Canal Street, N. Y., carry a complete stock of iron and brass machine and wood screws, bolt, cap and set screws, taps, dies, files, twist drills, brass and rubber tubing, rod and sheet copper, brass, German silver, steel and iron wire, shafting, tools, etc.

St. Paul, Minn.—The Hill Clutch Works, of Cleveland, O., are shipping this week the fifth and final car of power transmission machinery to the St. Paul Gas Company for their electric light station. Only half of the proposed plant of machinery is being put in the building. When it is fully completed it will be one of the largest in the country, besides being a model plant in every respect.

Belt Holders.—Among the late inventions mentioned in these columns the Schenck belt holder and shifter is attracting considerable attention, and the main office at 93 Liberty street reports general inquiry from electric light men, particularly those who are just establishing new plants. Thus far perfect satisfaction has been given, both as to efficiency and cost. Address as above if estimates, drawings, etc., are desired.

The Partz Electric Battery Company, of Philadelphia, having found their old quarters at 1,723 Chestnut street too small, have leased the large building at 636 Arch street, same city. They are now prepared to fill all orders promptly, and in addition to their large line of Open Circuit and Gravity and Motor Batteries, have a full line of small Motors and Dynamos. Send for their price list and catalogue, or write to them, stating what you want.

The Hill Clutch.—The Eastern office of the Hill Clutch Works, 18 Cortlandt street, New York, report a very large demand for their clutch pulleys and couplings and power transmission machinery, and have recently made large shipments to Brookfield, Mass.; Lafayette, R. I.; Petersburg, Va.; Framingham, Mass.; Asbury Park, N. J.; Willimantic, Conn.; Baltimore, Md.; Providence, R. I.; Newark, N. J.; Boston, Mass.; Plainfield, N. J.; Pittsfield, Mass.; Ansonia, Conn.; Amesbury, Mass.; Tolland, Conn.; Peterborough, N. H.; Augusta, Me.; Lawrence, Mass, and Wilmington, Del.

McIntosh, Seymour & Co., of Auburn, N. Y., have recently brought out a line of high-speed compound condensing engines, which are self-contained and are especially adapted for direct belting to dynamos, combining as they do the highest commercial economy, and the greatest convenience and reliability in operation. They have met a very favorable reception. The Westfield Gas Light Company, of Westfield, Mass., have one of 55 and one of 80 h. p., and two of 100 h. p. each are now being installed in the Thomson-Houston station at Auburn, N. Y. This firm have found the demand for this style and for their standard engine to be so great that they are at present doubling the capacity of their shops.

OUR ILLUSTRATED RECORD OF ELECTRICAL PATENTS.

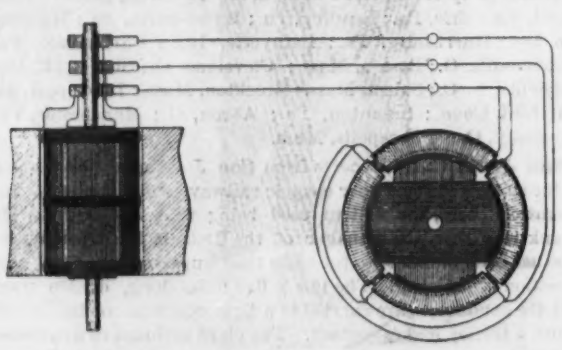
PATENTS DATED OCTOBER 2, 1888.

390,196. Device for Protecting Electric Conductors; Edward G. Acheson, Pittsburgh, Pa. Application filed June 2, 1888. See THE ELECTRICAL WORLD, Sept. 8, 1888.

390,220. Magnetic Cleaning Apparatus; Alwin Hempel, Dresden, Saxony, Germany. Application filed Aug. 22, 1887. Patented in Germany Oct. 1, 1887, No. 42,950; in Belgium Oct. 31, 1887, No. 79,250, and in France Jan. 17, 1888, No. 186,584. In a magnetic cleaning machine, the pole tips extending upward under an obtuse angle and arched or of roof-like form, so that the material to be cleaned will not remain lying on the same.

390,230. Apparatus for Synchronizing Clocks; C. F. Hoefling, London, England. Application filed April 25, 1887. Patented in England Oct. 8, 1886, No. 12,840. The synchronizing or setting devices are so arranged that if, owing to the current becoming permanent, or to any other cause, the armature remains in contact with the electro magnet, the hand is not retained, and, therefore, the clock is not stopped or its regular working interfered with.

390,245. Electric Arc Lamp; Richard H. Mather, Windsor, Conn. Application filed Feb. 20, 1888. An electro-magnet provided with a solenoid armature which is wound with two independent helices, namely, a main circuit helix



390,413. SYSTEM OF ELECTRICAL DISTRIBUTION.

and a shunt circuit helix, both having constantly closed circuit connections. See illustration.

390,301. Armature Core for Dynamos; W. S. Hill, Boston, Mass. Application filed Oct. 12, 1887. An armature core composed of a series of discs having side flanges arranged to be secured upon a shaft.

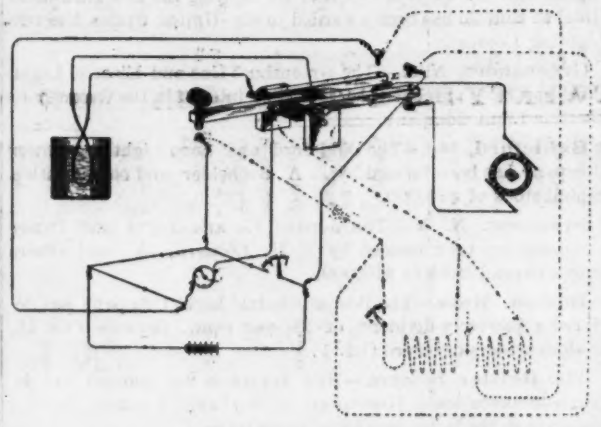
390,310. Electrical Testing Apparatus; James W. Packard, New York, N. Y. Application filed May 4, 1888. The invention consists in a suitable arrangement of electric circuits and contact making devices, by which a circuit which is being supplied with a current from any suitable source for the purpose of varying its resistance, may be cut out from such source of current and thrown into circuit with a suitable testing device without moving any of the various parts of the apparatus other than the lever of the cut-out or switch. See illustration.

390,318. Alternate Current Dynamo; Elihu Thomson, Lynn, Mass. Application filed July 25, 1887. An armature provided with two coils, one applied to the exterior or periphery thereof, and furnishing the working or line current, and the other being wound longitudinally over the same armature structure and supplying the exciting current for the machine. See illustration.

390,329. Electric Circuit Controller; A. F. L. Wilatowsky, Stamford, Conn. Application filed April 19, 1888. The invention relates to a new form of electric connection especially adapted for doors, windows, floors and other locations in a system of burglar alarms, and arranged so that it can be readily changed from a circuit-breaker to a circuit-closer.

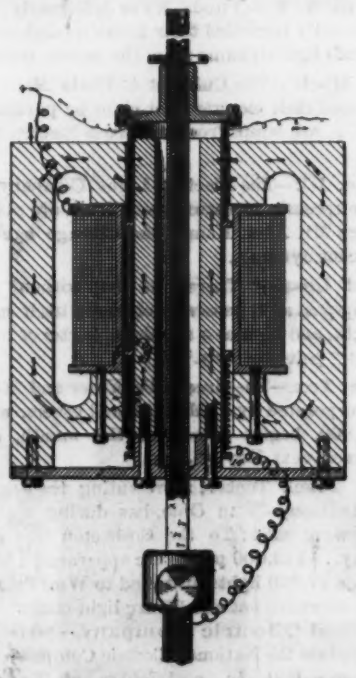
390,354. Galvanic Abdominal Truss; Louise Epplé, Chicago, Ill. Application filed June 23, 1888. This has for its object to provide a separate battery for each of the two arms or abdominal pads of a duplex truss, whereby the galvanic action contemplated may be obtained through one abdominal pad while it is suppressed at the other.

(1) 390,413. (2) 390,414. (3) 390,415. (1) System of Electrical Distribution; (2) and (3) Dynamo Electric Machines; Nikola Tesla, New York, N. Y., Assignor to the Tesla Electric Company, of same place. Applications filed respectively April 10, April 23, and May 15, 1888. (1) A



390,310. ELECTRICAL TESTING APPARATUS.

system of electrical distribution consisting of an alternating current generator, having independent generating circuits and electro magnetic motors or converters provided with corresponding energizing circuits, of line wires or conductors connecting the coils of the motors or converters respectively, in series with one terminal of each circuit of the generator, and



390,245. ELECTRIC ARC LAMP.

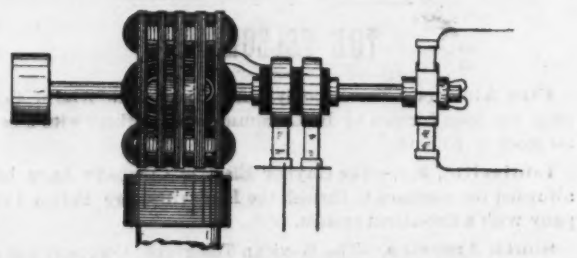
a single return wire or conductor connecting the said conductors with the other terminals of the generator. See illustration. (2) Claim: The combination with a converter, provided with independent energizing circuits of a continuous or direct current generator provided with continuous collecting rings connected in derivation to the armature coils to form the terminals of circuits corresponding to those of the converter. (3) A novel form of frame and field magnet, which renders the machine more solid and compact as a structure.

390,423. Telephone; Parvin Wright, Denver, Col., Assignor of seventy-one hundredths to Peter C. Horn and Cecelia R. Northrop, both of same place. Application filed March 6, 1888. Briefly stated, the invention consists in providing a telephone with an electro-magnet, the coils of which are included in an electric circuit, and providing resistance devices in an independent circuit operated upon in an improved way by the electro-magnet to vary their conductivity.

390,439. Dynamo-Electric Machine; Charles S. Bradley, Yonkers, N. Y. Application filed May 9, 1887. Claim 1: An alternating-current dynamo electric machine having generative conductor, in combination with two pairs of current-leading devices, said pairs being respectively connected to the generative conductors, so as to collect two independent alternating currents, one of which has its time phase substantially one fourth of a wave length or period behind the other.

390,462. Process of Making Carbon Filaments; Thomas A. Edison, Llewellyn Park, N. J. Application filed Nov. 9, 1887. The object of the invention is to produce a method or process by which the two or more carbon filaments designed for use in series in one lamp globe can be made of unflashed carbons and will have the same resistance per unit of radiating surface.

(1) 390,463. (2) 390,464. (1) Distribution and Control of Electrity for Lighting; (2) System of Utilizing Secondary Batteries; Henry Edmunds, London, England. Applications filed June 21, 1888. Claim: The method of utilizing secondary or storage batteries in installations for electric lighting and other purposes, employing a main or charging circuit and local or working circuits at different stations, said method consisting in arranging the batteries at each station in sets or groups, and transferring each set or



390,318. ALTERNATE CURRENT DYNAMO.

group in turn from the working circuit into the charging circuit for short periods of time without short circuiting the batteries or breaking the charging or working circuits so that all but one of the sets or groups are in the working circuit at any instant of time. See page 199, this issue.

390,481. Electric Light Circuit Cut-Off Switch; W. A. Johnston, Toronto, Canada; application filed. In this switch the levers will make contact with the binding posts of one circuit before they break with the others.

390,544. Therapeutic Electrode; James H. Woodward, Seward, Nebraska. Application filed Nov. 21, 1887. The invention consists in a new electrode, which is designed to be employed to transmit a volatile substance—such as chloroform, ether, etc.—by means of an electric current, into a diseased part of the body for the cure of local diseases.

390,575. Telephonic Transmitting Instrument; Robert D'Unger, Chicago, Ill., Assignor of four-tenths to Wm. L. Copeland, of same place. Application filed Jan. 9, 1888. The invention consists in applying the principle of leverage to increase the effect of the vibrations of the diaphragm; also, in a means of adjustment of the microphonic contacts.

390,597. Porous Cup for Galvanic Batteries; E. M. Hewett, Newton, Assignor, by direct and mesne assignments, to James L. Little, Jr., of Brookline, Mass. Application filed April 30, 1888. The porous cup is sized interiorly or exteriorly, or both, with a coating of gelatinous material, rendered insoluble by the application of chrome alum or chromic acid.

390,619. Apparatus for Removing Ice from Railway Tracks; Elias E. Ries, Baltimore, Md., Assignor to Ries & Henderson, of same places. Application filed Dec. 9, 1887. This invention is designed to clear the conductors when necessary, of ice or snow. It consists of a source of electricity feeding the circuit with continuous high tension currents, and an auxiliary source feeding the same circuit with low tension alternating currents.